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ABSTRACT

This report examines the relationship between high school academic curricula and students' persistence path through college, approximately 3 years after first enrolling. Data are from the 1995-1996 Beginning Postsecondary Students Survey, a longitudinal study of beginning postsecondary students who first enrolled in a four-year college in 1995-1996. Measures of high school academic preparation are based on academic courses taken in high school as reported by students on their college entrance examination applications. Approximately one-third of the students reported completing course work no higher than core curricula. One-half reported completing mid-level curricula, and the remaining one-fifth completed rigorous curricula. As of 1998, roughly two-thirds of students who had first enrolled in a four-year college in 1995-1996 were still enrolled in the same college. One-fifth had transferred to another institution, and 13% had left and not returned. The level of college students' high school curriculum was strongly related to their persistence in postsecondary education. This was true both for maintaining enrollment at their initial institution and, if they transferred, staying on track to a bachelor's degree. The difference between levels of academic curricula was especially notable with respect to staying on track to a bachelor's degree. Findings demonstrate a consistent advantage experienced by students who completed rigorous high school curricula, and to a lesser extent, by those competing mid-level curricula, over their peers completing core curricula or lower. However, the level of high school curricula students reported completing was also related to their family background characteristics and indicators of socioeconomic status. Two appendixes contain a glossary and technical notes. (Contains 14 tables, 10 figures, and 16 references.) (SLD)

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High School Academic Curriculum and the Persistence Path Through College

Persistence and Transfer Behavior of Undergraduates 3 Years After Entering 4-Year Institutions

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Executive Summary

This report examines the relationship between high school academic curricula and students' persistence path through college, approximately 3 years after first enrolling. The data are drawn from the 1995–96 Beginning Postsecondary Students Survey, a longitudinal study of beginning postsecondary students who first enrolled in a 4-year college in 1995–96. Measures of high school academic preparation are based on academic courses taken in high school as reported by students on their college entrance exam applications.

The high school academic curriculum measure identifies three levels of coursetaking: (1) Core curriculum or below, (2) mid-level, and (3) rigorous. The lowest threshold is based on the core New Basics curriculum first recommended by the National Commission on Excellence in Education in *A Nation at Risk* (1983). Core curriculum includes 4 years of English, 3 years of mathematics, 3 years of science, and 3 years of social studies.[1] The highest threshold, or rigorous curriculum, identified in the current study, includes 4 years of English, 3 years of a foreign language, 3 years of social studies, 4 years of mathematics (including pre-calculus or higher), 3 years of science (including biology, chemistry, physics), and at least one Advanced Placement (AP) course or test taken. Mid-level covers curricula between core and rigorous curricula, but at a minimum must include algebra I, geometry, at least 1 year of a foreign language, and two science classes from the combination of biology, chemistry, and physics.[2]

Level of High School Academic Curriculum Completed

The distribution of beginning students enrolled in 4-year institutions across the three levels of course taking is displayed in figure A. Approximately one-third (31 percent) reported completing course work no higher than core curricula, one-half completed mid-level curricula, and the remaining one-fifth (19 percent) completed rigorous curricula.

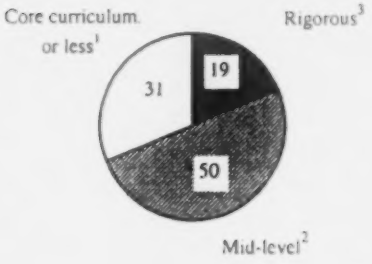
The level of high school academic curriculum completed by beginning 4-year college students was associated with their demographic and socioeconomic characteristics and also with the economic status of the student body in their high schools. Specifically, students from low-income families, students whose parents had no more than a high school education, and students who graduated from high schools in which 25 percent or more of the students were eligible for free or reduced-price lunches were less likely than their more advantaged counterparts to report completing rigorous high school curricula.

Related in part to family income, racial/ethnic group differences also were apparent. Black stu-

[1] It also included courses in computer science, but students did not report on such courses on their entrance exam applications.

[2] The research of Burkam, Lee, and Smerdon (1996) and Adelman (1999) was used extensively in guiding the development of the variable.

Figure A.—Percentage distribution of 1995–96 beginning postsecondary students who enrolled in 4-year institutions, by high school academic curriculum



[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

dents were much less likely than either White or Asian/Pacific Islander students to complete rigorous curricula (8 percent versus 20 and 31 percent, respectively) and more likely to complete programs no higher than the core curriculum (42 percent versus 29 and 27 percent). Asian/Pacific Islander students were the most likely to complete rigorous curricula (31 percent). While it appears as though White students were more likely than Hispanic students to complete rigorous curricula (20 percent versus 16 percent) and less likely to complete no higher than core curricula (29 percent versus 34 percent), there was not enough statistical evidence to draw this conclusion.

High school academic curriculum also had an obvious association with where students first enrolled in college. As the level of curricula increased, so did students' likelihood of attending selective 4-year colleges or universities.[3] For example, 71 percent of students who completed rigorous curricula enrolled in a selective college or university, compared with 40 percent who completed mid-level curricula and 32 percent who completed core curricula or lower.

Postsecondary Persistence 3 Years After Enrolling

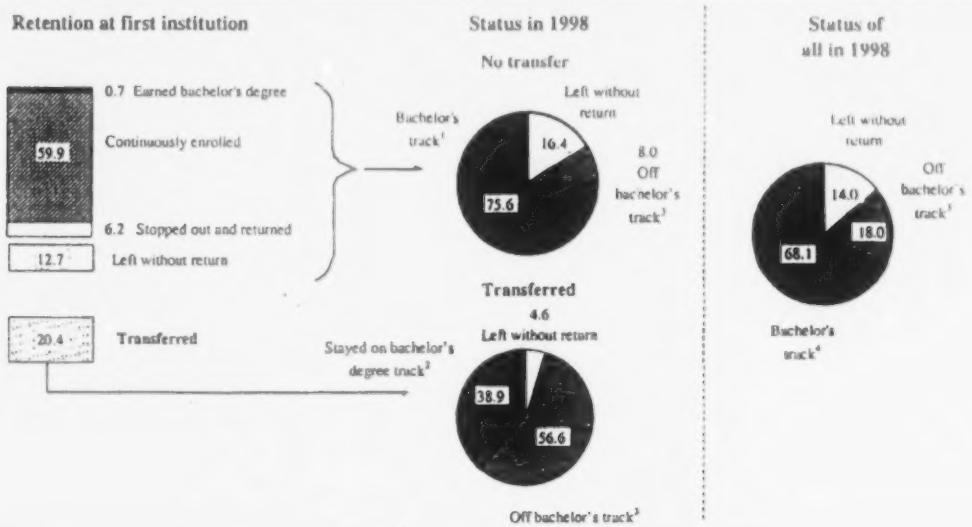
As of 1998, roughly two-thirds of students who had first enrolled in a 4-year college in 1995–96 were still enrolled in the same college (including 6 percent who had left and returned; figure B). One-fifth had transferred to another institution, and 13 percent had left and not returned.

The level of college students' high school curricula was strongly related to their persistence in postsecondary education. This was true both for maintaining enrollment at their initial institution (institutional retention) and, if they transferred, staying on track to a bachelor's degree.[4] For example, 79 percent of students who had participated in rigorous high school academic curricula were continuously enrolled in their initial institution (including 1 percent who had attained a bachelor's degree; figure C). In contrast, 62 percent and 55 percent, respectively, of those in mid-

[3]Selectivity was determined by admitted students' entrance exam scores. See appendix A for definition.

[4]The "persistence track" to a bachelor's degree is defined as maintaining uninterrupted enrollment in a 4-year institution toward a bachelor's degree objective. It includes those who transfer between 4-year institutions without a break in enrollment. The persistence track concept was first developed by Carroll (1989) to demonstrate the optimal path to a bachelor's degree and the adverse effects of straying from the path.

Figure B.—Postsecondary persistence path of 1995–96 beginning students who enrolled in 4-year institutions, 3 years after first enrollment (as of 1998)



[1]Maintained continuous enrollment in first institution or earned a bachelor's degree.
[2]Transferred to a 4-year institution with no break in enrollment.
[3]Stopped out (break of more than 4 months) and/or enrolled in a less-than-4-year institution.
[4]Maintained continuous enrollment in any 4-year institution.

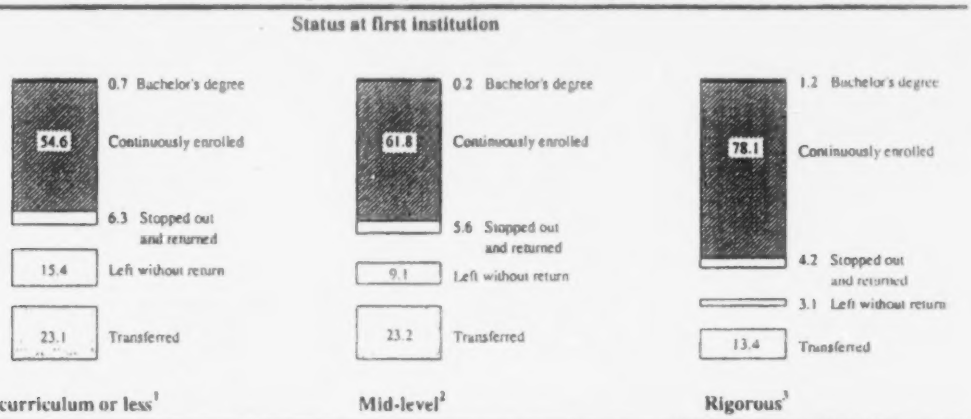
NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

level curricula or core curricula or lower were continuously enrolled in their initial institution. Students in rigorous curricula also were less likely to transfer from their first institution (13 percent) than those who participated in less than rigorous curricula, whether in mid-level or core or lower curricula (23 percent of both groups transferred).

The difference between levels of academic curricula was especially notable with respect to staying on track to a bachelor's degree (i.e., continuous enrollment in any 4-year institution). As the level of academic curricula increased, so did the proportion of undergraduates who stayed on track (figure D). As of 1998, the vast majority (87 percent) of those who had participated in rigorous high school academic curricula were still on track to a bachelor's degree, compared with 71 percent of those in mid-level curricula, and 62 percent of those who completed core curricula or lower. Correspondingly, the proportion of those who had left postsecondary education and did not return declined with each successive level of academic curriculum (from 17 percent to 10 percent to 4 percent).

Figure C.—Percentage distribution of 1995–96 beginning students' 1998 enrollment status in their first institution for those who began in a 4-year institution, by high school academic curriculum



[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

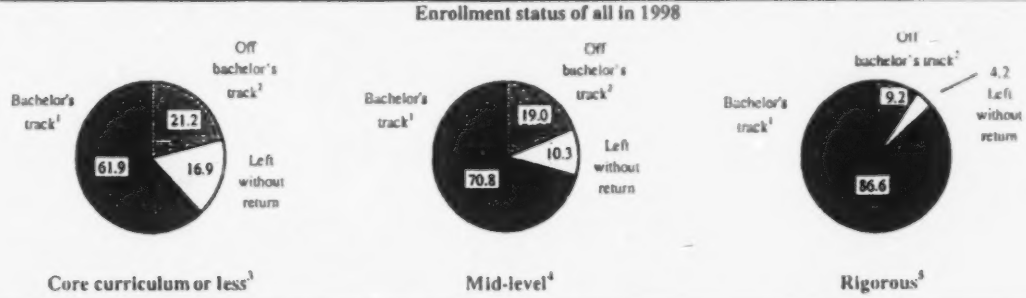
[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Figure D.—Enrollment status in 1998 of 1995–96 beginning students who first enrolled in 4-year institutions, by high school academic curriculum



[1]Continuously enrolled in any 4-year institution.

[2]Stopped out (break of 4 or more months) and/or enrolled in a less-than-4-year institution.

[3]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[4]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[5]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

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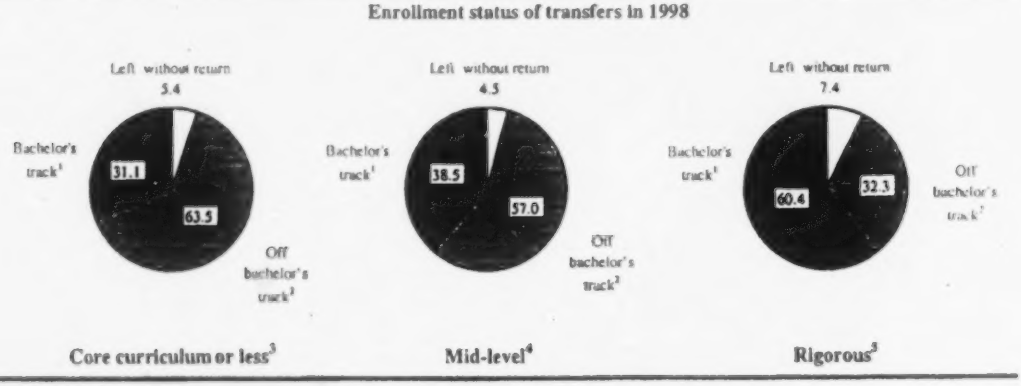
Patterns of Transfer

The rate of transfer for those who completed no higher than a core curriculum in high school was the same as for those who completed mid-level curricula. Roughly one-quarter of these students had transferred from their first institution, while just 13 percent in rigorous high school curricula had done so. However, as shown in Figure E, among students who transferred, as their level of academic curricula increased, so did the likelihood of staying on track to a bachelor's degree (i.e., they transferred to another 4-year institution without a break in enrollment). For those who had completed core curricula or lower, 31 percent of transfers stayed on the bachelor's degree track, as did 39 percent of transfers who had completed mid-level curricula and 60 percent of those who had completed rigorous high school curricula.

These differences were clearly evident when examining the destination of transfers. Staying on track to a bachelor's degree implies staying enrolled in a 4-year institution, so all transfers who stayed on track transferred to 4-year institutions. However, there were also differences across high school academic curricula with respect to the selectivity of the 4-year institutions where students transferred (table A). Among all transfers who completed rigorous high school curricula, 40 percent transferred to selective institutions, compared with just 21 percent of their counterparts who completed mid-level curricula and 17 percent who

Figure E.—For 1995–96 beginning students who transferred from a 4-year institution, percentage distribution of enrollment status in 1998 with respect to earning a bachelor's degree, by high school academic curriculum



[1]Continuously enrolled in any 4-year institution.

[2]Stopped out (break of 4 or more months) and/or enrolled in a less-than-4-year institution.

[3]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[4]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[5]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Table A.—Among 1995–96 beginning students who transferred from a 4-year institution, percentage distribution according to their transfer institution, by high school academic curriculum and selectivity of first institution

	Transfer destination		
	4-year institution		Less-than-4-year or for-profit 4-year
	Selective[1]	Less-selective[2]	
	All transfers from 4-year institutions		
Total	21.3	39.5	39.3
High school academic curriculum			
Core curriculum or less[3]	17.4	36.9	45.7
Mid-level[4]	20.9	39.0	40.1
Rigorous[5]	40.4	38.9	20.8
	Began in selective institution		
Total	34.1	30.0	35.9
Core curriculum or less[3]	21.5	31.4	47.1
Mid-level[4]	32.8	27.6	39.6
Rigorous[5]	48.5	32.4	19.1
	Began in less-selective institution		
Total	14.7	44.3	41.0
Core curriculum or less[3]	16.2	38.4	45.4
Mid-level[4]	13.3	46.2	40.5
Rigorous[5]	25.0	50.9	24.0

[1]Selective institutions are public and private not-for-profit institutions in which students' average SAT scores exceeded 1000 or Carnegie classifications in which a majority of students were enrolled in very selective institutions.

[2]Less-selective institutions are all others not identified in the selective groups.

[3]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[4]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[5]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

completed core curricula or lower. Correspondingly, transfers who completed rigorous curricula were much less likely to transfer either to a less-than-4-year or a for-profit institution (21 percent) than their counterparts in mid-level (40 percent) or core curricula or lower (46 percent).

Examining the selectivity of students' first institution with their second, the likelihood of making a lateral transfer from selective to selective institution was much higher for those completing rigorous high school curricula (49 percent) than for those completing either mid-level curricula (33

percent) or no higher than core curricula (22 percent). Similarly, the likelihood of transferring from a selective institution to a less-than-4-year or for-profit institution was much lower for those completing rigorous curricula (19 percent) than for their counterparts completing mid-level curricula (40 percent) or no higher than core curricula (47 percent).

While the patterns of transfer appear to be similar among those who began in less-selective institutions (i.e., those completing rigorous high school curricula more likely than those in less rigorous curricula to transfer to selective institutions or to transfer laterally, and less likely to transfer to less-than-4-year or for-profit institutions), there is not enough statistical evidence to draw this conclusion.

Transfers left postsecondary education at similar rates no matter what their high school academic curricula. As shown in figure E, 5 to 7 percent of transfers left postsecondary education altogether as of 1998.

Controlling for Related Variables

In addition to high school academic curricula, many other variables can influence postsecondary education outcomes. Therefore, it is necessary to use multivariate analysis techniques to disentangle the net influence of related variables on the outcome of interest.

In this study, covariance adjustment techniques based on simple linear regression models were used to analyze two persistence outcomes: (1) continuous enrollment at the initial institution, and (2) staying on track to a bachelor's degree. Independent variables reflected students' academic experience in high school (academic curricula and college entrance exam scores), demographic characteristics (gender, race/ethnicity, age), socioeconomic characteristics (income and parents' education), and the economic status of their high schools (the proportion of students eligible for free or reduced-price lunches). Other variables reflected students' experiences in their first year in college, including the type of postsecondary institution, full- or part-time attendance, and work status. In addition, because previous research has shown first-year grade-point average (GPA) to be a strong predictor of success in college (e.g., Pascarella and Terenzini 1991), both analyses were run twice, once without GPA, and once including GPA as an independent variable.

High School Academic Curricula

The results indicated a strong association between high school academic curricula and both measures of persistence. Students who participated in rigorous high school curricula were at a distinct advantage over those who completed no higher than core curricula (the comparison group). In addition, there was some evidence that completing mid-level curricula also was associated with higher rates of staying on track to a bachelor's degree when compared to those completing programs no higher than core curricula. However, the difference did not reach statistical significance after adjusting for the design effect of the dependent variable.[5]

SAT Scores and Other Variables

In both persistence analyses, prior to including first-year college GPA as an independent variable, SAT composite test score levels and high school academic curriculum levels were significantly associated with the outcome. However, once GPA

[5]After adjusting for the design effect, the *t*-value of the coefficient was 1.90. See appendix B for a description of methods and adjustment for design effect.

was taken into account, high school academic curriculum remained a significant predictor of persistence (specifically, completing a rigorous versus core or lower curriculum), but the association between levels of SAT scores and persistence disappeared. In other words, once all related variables were taken into consideration including college GPA, entrance exam scores were no longer associated with the likelihood of persisting, either with respect to institutional retention or staying on track to a bachelor's degree.

Other variables were also significantly associated with both measures of persistence after holding related variables consistent. For example, students whose parents did not attend college were less likely to persist than those whose parents were college-educated.[6] In addition, students who started college attending part time and/or working full time were less likely to persist than their counterparts, as were those who first enrolled in less-selective 4-year institutions compared with those in selective institutions.

Conclusions

The findings of this study demonstrated a consistent advantage experienced by students who completed rigorous high school curricula, and to a lesser extent by those completing mid-level curricula, over their peers completing core curricula or lower.

However, the level of high school curricula students reported completing also was related to their family background characteristics and indicators of socioeconomic status, including family income, parents' education, race/ethnicity, and the economic status of their high school's student body. All of these factors relate to whether or not students have the opportunities to participate in and complete rigorous curricula. Moreover, students' success in staying in college was also related to where they first enrolled and how well they did in their first year. Yet, even when all these factors were taken into consideration, the advantage of completing a rigorous high school academic curriculum remained.

The same was not observed for levels of SAT scores. Similar to the findings for curriculum levels, SAT scores were related to persistence when first-year college GPA was not included in the regression. However, after GPA was added, high school curriculum remained a significant factor, but SAT scores did not. These findings are consistent with recent research based on high school transcripts for a cohort of 1980 high school sophomores (Adelman 1999); this study demonstrated that high school curriculum was a stronger predictor of bachelor's degree attainment than standardized test scores or other measures of high school academic performance.

Perhaps most notable in the current study, is the apparent benefit of a strong high school academic curriculum for transfer students. Students who transfer from their initial 4-year college may do so because they are struggling either academically or socially, and attempting to find a better fit in another institution. One-fifth of 1995–96 beginning undergraduates enrolled in 4-year colleges had transferred from their first institution by 1998. For these students in particular, as their level of high school academic curriculum increased, so did their likelihood of staying on track to a bachelor's degree (by transferring to another 4-year institution without a break in enrollment).

[6] A recent NCES report provides a detailed analysis of the experiences of "first-generation" college students—those whose parents did not attend college (Warburton, Bugarin, and Nuñez 2001).

Taken together, the results suggest that completing a rigorous academic curriculum in high school may help students overcome socioeconomic disadvantages such as low family income and parents with no college experience, as well as helping those who get a poor start in college (whether academic or social) and decide to transfer.

Foreword

This report examines the relationship between high school academic curricula and students' persistence path through college, approximately 3 years after first enrolling. The data are drawn from a longitudinal survey of beginning postsecondary students who first enrolled in a 4-year college in 1995–96 (BPS:96/98). Measures of high school academic preparation are based on academic courses taken in high school as reported by students on their college entrance exam applications. These data come from Educational Testing Service (ETS) and the American College Testing (ACT) Program.

The estimates presented in the report (mostly percentages) were produced using the NCES Data Analysis System (DAS) for the BPS:96/98 survey. The DAS is a PC-based application that allows users to specify and generate their own tables. With the DAS users can also generate correlation coefficient matrices to use as input data for standard regression procedures. The DAS produces design-adjusted standard errors necessary for testing the statistical significance of differences shown in the tables. For more information regarding the DAS, readers should consult appendix B of this report.

Acknowledgments

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Members of the PEDAR Technical Review Panel (TRP) who reviewed the preliminary results included Clifford Adelman, Paula Knepper, and Roslyn Korb at NCES; and Jacob Stampen from the University of Wisconsin.

The final report was reviewed by the following adjudication panel members at the U.S. Department of Education: Bernie Greene (Early Childhood and International and Crosscutting Studies Division), Jeff Owings (Associate Director, Elementary/Secondary and Library Studies Division), Karen Wenk (Office of Postsecondary Education), and Ann Mullen (National Institute on Postsecondary Education, Libraries and Lifelong Learning); Bruce Taylor (Statistical Standards Program of ODC) served as the panel chair. Special thanks to Jacqueline King, Director of Research at the American Council on Education, for reviewing both the preliminary results and the final report. The authors wish to thank all of these individuals who helped shape and strengthen the final report.

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Introduction

The importance of improving the academic curricula of American youth to better prepare them for college is evident in the first stated goal of Gear Up, the U.S. Department of Education's outreach program designed to help disadvantaged youth pursue postsecondary education—"to promote significant growth in student academic achievement through high standards and a rigorous academic core curriculum beginning as early as middle school."[1]

Beginning in the late 1970s, Karl Alexander and others demonstrated that measures of high school students' "academic resources" are much stronger predictors of educational outcomes than are social background factors including gender, race, and socioeconomic status (Alexander and Cook 1978, 1982; Alexander, Holupka, and Pallas 1987; Alexander, Riordan, Fennessey, and Pallas 1982). One study in particular (Alexander et al. 1982), examined college graduation rates of high school seniors using the National Longitudinal Study of 1972 (NLS-72) with respect to their social background factors and high school academic resources (defined as college or non-college curriculum track, standardized test scores, and class rank). The authors concluded that academic factors were by far the strongest predictors of degree attainment. Once academic resources were taken into consideration, there were no differences by gender, modest differences by race (Black students had higher completion rates), and larger differences by socioeconomic status.

Recently, Adelman (1999) examined graduation rates among 1980 high school sophomores using High School and Beyond (HS&B) data. Through the analysis of high school transcripts, he developed a much more complex curriculum variable based on the intensity and quality of courses taken. The findings of this study indicated that the academic curriculum variable was a better predictor of degree attainment than standardized test scores or class rank.

The current study examines the association between high school curricula and college persistence and transfer patterns for a cohort of students who first enrolled in a 4-year college in 1995–96, and who were followed up three years later in 1998 (BPS:96/98). Unlike age cohort surveys, the BPS survey is made up of all students who enter college in a given year, including older students who have delayed enrollment. In a previous report, Berkner, Cuccaro-Alamin, and McCormick (1996) reported extensively on the persistence and degree attainment of an earlier

[1]U.S. Department of Education, *http://www.ed.gov/gearup/funding/FY2001.html*.

BPS cohort who entered postsecondary education in 1989–90. However, the earlier survey data lacked measures of high school academic curricula. Thus, it was not possible to determine the impact of high school academic preparation on students' persistence or transfer behavior once they reached college. The newer BPS survey includes data obtained from the SAT and ACT testing agencies, which in addition to college admission test scores, contain self-reports of high school courses completed. BPS:96/98 also contains information on characteristics of the students' high schools from the Common Core of Data (CCD). These additional data provide the opportunity to examine students' academic preparation for college in more depth.

Using these data, the analysis examines the association between levels of high school academic curricula on measures of persistence 3 years after first enrolling in a 4-year college or university addressing the following questions:

- How were college students' high school academic curricula related to measures of postsecondary persistence?
- How did students' high school academic curricula relate to transfer behavior, in particular, whether or not they stayed on track to a bachelor's degree?
- To what types of institutions (i.e., more or less selective 4-year, or less-than-4-year institutions) did students transfer and how was this related to high school academic curricula?

Data and Definitions of Key Variables

This analysis uses data from the first follow-up of the Beginning Postsecondary Students cohort who first entered postsecondary education in 1995–96 (BPS:96/98). In addition, student reported high school academic courses taken were derived from applications to take the SAT or ACT college entrance exams. These data were obtained from Educational Testing Service (ETS) and the American College Testing (ACT) Program.[2] Data were available for 93 percent of students at 4-year institutions (public and private not-for-profit) and for 43 percent of those at public 2-year institutions. Because high school coursetaking data were not available for a majority of students who began in 2-year institutions, this study is limited to students who began college at public or private not-for-profit 4-year institutions. The small percentage of students who first enrolled in 4-year private for-profit institutions (0.4 percent) was excluded from the analysis.

High School Academic Curriculum

The definition of levels of academic curricula used in this analysis was based on three sources: the core curriculum recommended in *A Nation at Risk* as "New Basics" by the National Commission on Excellence in Education (1983), the high school mathematics course-level analyses of Burkam, Lee, and Smerdon (1996), and Adelman's (1999) research on the effects of secondary school courses taken on postsecondary outcomes.

The core curriculum includes 4 years of English, 3 years of mathematics, 3 years of science, 3 years of social studies, and one-half year of computer science.[3] The core curriculum represents the threshold for the lowest level of course taking in this analysis defined as follows:

---

[2]Previous research comparing student self-reports to transcripts indicates that although students tend to inflate their grades, they fairly accurately report the courses they took in high school. A 1999 analysis by the American College Testing Program's Department of Research Services compared courses reported by approximately 12,000 ACT test takers across the nation in 1995–96 with their high school transcripts. For courses identified in the high school academic curriculum variable, between 1 percent and 17 percent of courses reported as taken or planned to take were not identified on their transcripts. This is generally consistent with two earlier ACT studies: a 1987 study of high school students in two states that found 94 percent agreement between self-reported courses taken and official high school transcripts; and a 1988 national study that found 87 percent overall accuracy of student self-report of courses taken compared to high school transcripts, without adjusting for missing data. However, the 1999 ACT analysis mentioned above also found that between 23 percent and 34 percent of self-reported grades for courses included in the high school academic curriculum variable were higher than those on high school transcripts. Based on these findings, self-reported grades are not included as an indicator of academic preparation/achievement.

[3]Data concerning computer science courses taken were not available for this study because the subject was not separately identified on admission test application forms.

- ***Core curriculum or below***: 4 years of English, 3 years of mathematics, 3 years of science, and 3 years of social studies.
- ***Mid-level curriculum:*** exceeds core curriculum by the addition of at least 1 year of a foreign language; also, two of the mathematics courses must have included algebra I and geometry, and the science courses must have included two of the following: biology, chemistry, or physics.[4]
- ***Rigorous curriculum:*** at least 4 years of English, 3 years of a foreign language, 4 years of mathematics (including precalculus or higher), 3 years of science (including biology, chemistry, and physics), 3 years of social studies, and at least 1 honors or advanced placement (AP) course or, if missing, an AP test score.[5]

Each successive curriculum level includes students who took at least the specified number of years of subjects and courses but did not meet the parameters of the next higher level. The distribution of beginning students in 4-year public or private not-for-profit institutions according to this definition of high school curriculum is shown in figure 1. Roughly one-third (31 percent) had completed academic curricula no higher than the core level, one-half had completed a mid-level curriculum, but did not meet the criteria for rigorous, and about one-fifth (19 percent) completed a rigorous curriculum.

Postsecondary Persistence Measures

Two indicators of postsecondary persistence were used to determine the enrollment status of 1995–96 beginning postsecondary students. The time frame for both measures is about 3 years (the spring of 1998), so attainment of a bachelor's degree is relatively rare. The first measure of persistence identifies the enrollment status of undergraduates with respect to their first institution or institutional retention as follows:

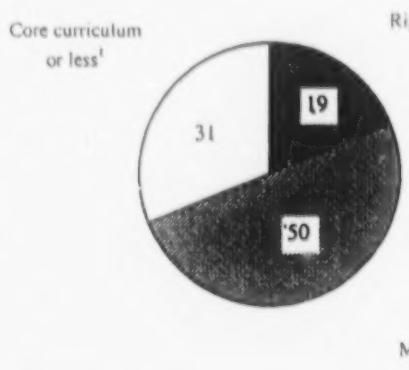
Institutional retention:

Retained

- Continuously enrolled in (or attained a degree at) the initial institution within the 3-year study period.
- Enrolled in the same institution in 1998, but stopped out at least once (had a break of more than 4 months in enrollment).

[4]This group was originally divided into two, with the higher group completing 2 years of a foreign language, algebra II, biology, chemistry, and physics. But few differences in outcomes were detected for the two middle groups, so they were combined.
[5]Test scores were available for about 20 percent of students who took AP tests.

Figure 1.—Percentage distribution of 1995–96 beginning postsecondary students who enrolled in 4-year institutions, by high school academic curriculum



[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.
[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.
[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Not retained

- Transferred to another postsecondary institution without a break in enrollment.
- Transferred to another institution after a break in enrollment of more than 4 months.
- Left postsecondary education (not enrolled at their initial institution, did not attain a degree, and did not transfer to another postsecondary institution).

The second persistence measure characterizes the postsecondary enrollment behavior of students 3 years after entering 4-year institutions with respect to staying on track to a bachelor's degree. The "persistence track" is a concept first developed by Carroll (1989), who analyzed the outcomes of 1980 high school sophomores with respect to their postsecondary enrollment. He determined the optimal path for completing a bachelor's degree and demonstrated the hazards of straying from the path. It was later applied to the first BPS cohort (BPS:89/94) by Berkner, Cuccaro-Alamin, and McCormick (1996).

Persistence track to bachelor's degree:

- Stayed on track: maintained continuous enrollment at any 4-year institution for all 3 years, including students who transferred between 4-year institutions.
- Still enrolled, but off track: had a break in enrollment (4 or more months) and/or transferred to a less-than-4-year institution.
- Left postsecondary education without returning (includes those who transferred and then left).

Other Variables

College Admission Test Scores

Performance on a standardized college admission test reflects SAT I original scale composite scores or their equivalents derived from ACT Assessment composite scores. ACT Assessment composite scores were converted to estimated SAT composite scores using a concordance table (Marco, Abdel-Fattah, and Baron 1992).

College Grade-Point Average (GPA)

Students' academic performance at their initial 4-year institution is based on their first-year grade-point average, as recorded by those institutions. The GPA of students who left their initial institution before the end of the first academic year reflects their grades for the period they were enrolled.

Postsecondary Institution Type and Transfer Destination

Types of 4-year institutions are based on institution control (i.e., public or private not-for-profit) and Carnegie classification. Public and private not-for-profit institutions were aggregated into two categories, "selective" and "less selective" classifications within Carnegie classifications. Carnegie classifications identified as selective were those in which the average SAT I (or equivalent ACT) scores of beginning students exceeded 1000 *or* in which a majority of students were enrolled in very selective institutions (institutions in which 75 percent of admitted students scored 1000 or higher on the SAT I test). The resulting aggregations differed between public and private not-for-profit institutions (see appendix A under entry for "ITCARCT3" for detail). The four categories are as follows:

- Public selective: Research I or II Universities, and Baccalaureate I institutions.
- Public less selective: all other public institutions.
- Private not-for-profit selective: Research I or II Universities, Doctoral I or II Universities, and Baccalaureate I institutions.
- Private not-for-profit less selective: all other private not-for-profit 4-year institutions.

In addition, transfer destination institutions include a fifth category:

- Less-than-4-year institutions (such as community colleges or trade schools) or for-profit 4-year institutions.

Multivariate Analyses

In addition to the univariate tabular analysis, multivariate analyses were conducted using the persistence measures as dependent variables. Independent variables included high school experiences (academic curricula, entrance exam test scores), student demographic characteristics (gender, race/ethnicity, age at college enrollment), socioeconomic background (family income and parents' education), and the economic level of their high schools' student body (as measured by the proportion of students eligible for free or reduced-price lunches). Other variables reflected students' experiences in college, including the type of postsecondary institution in which students first enrolled, first-year college grade-point average, attendance status (full or part time) when they started, and the number of hours worked while enrolled in their first year.

High School Academic Curriculum

About one-fifth (19 percent) of 4-year college students who first enrolled in 1995–96 reported completing rigorous high school academic curricula (figure 1). Not only had these students taken chemistry, physics, and at least one advanced mathematics course (precalculus or higher), they had studied a foreign language for at least 3 years and completed 4 years of English. In addition, they reported taking at least one advanced placement (AP) course or test. At the other end of the spectrum, roughly one-third (31 percent) of 4-year college students had completed programs no higher than the core curriculum, which the National Commission on Excellence in Education (1983) considered the minimum requirements for high school graduation. The remaining 50 percent had completed high school curricula that fell between core and rigorous curricula (mid-level). At a minimum these students took at least 1 year of a foreign language, and algebra I and geometry, and two of their science classes included a combination of biology, chemistry, or physics.

Factors Associated With High School Academic Curriculum

Differences in high school academic curriculum levels were found for several student demographic characteristics including race/ethnicity, age at college enrollment, family income, and parents' highest education. Students' college admission test scores and an indicator of the economic status of their high schools' student body also varied with the level of academic curricula students reported completing.

Student Demographic Characteristics

Nearly one-third of Asian/Pacific Islander students (31 percent) reported completing rigorous curricula, a much higher rate than all other racial/ethnic groups, including 20 percent of White students, 16 percent of Hispanic students, and 8 percent of Black students (table 1). White students were more likely than Black students to report completing rigorous curricula and less likely to report completing programs no higher than the core curriculum.[6] It also appeared as though White students were more likely than Hispanic students to complete rigorous curricula

[6]While it appears as though Hispanic students were more likely than Black students to report rigorous high school curricula, and less likely to complete core curricula or lower, the differences did not reach statistical significance.

Table 1.—Percentage distribution of 1995–96 beginning students in 4-year institutions, by high school academic curriculum levels and by selected student background and high school characteristics

	Core curriculum or less[1]	Mid-level[2]	Rigorous[3]
Total	31.0	50.3	18.7
Gender			
Male	32.5	47.5	20.1
Female	29.9	52.5	17.6
Race/ethnicity			
Asian/Pacific Islander	26.9	42.1	31.0
Hispanic	34.3	49.5	16.2
Black, non-Hispanic	41.6	50.3	8.1
White, non-Hispanic	29.0	51.4	19.7
American Indian/Alaskan Native	—	—	—
Age during first month enrolled			
18 years or younger	29.2	52.0	18.9
19 or older	42.1	40.3	17.6
Family income in 1994			
Low income	39.6	45.6	14.8
Middle income	30.8	51.6	17.6
High income	24.5	48.4	27.1
Parents' highest education			
High school or less	39.4	51.2	9.4
Some college	32.7	54.3	13.0
Bachelor's degree or higher	25.7	49.3	25.0
Derived SAT combined score			
Lowest quartile (400–790)	49.0	49.1	1.9
Middle quartiles (800–1090)	29.7	55.7	14.7
Highest quartile (1100–1600)	15.0	40.8	44.1
Free or reduced-price lunch eligibility at high school			
0–4 percent	24.7	48.2	27.1
5–24 percent	32.6	50.6	16.7
25 percent or higher	37.4	51.4	11.2

—Sample size too small for a reliable estimate.

[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

(20 percent versus 16 percent) and less likely to complete core curricula or lower (29 percent versus 34 percent), but there was not enough statistical evidence to draw this conclusion.

Unlike age cohort studies, the BPS survey includes older students who may have delayed college enrollment. Differences in academic curricula were apparent relative to age, but only at the lower levels. That is, students 19 or older completed programs no higher than the core curricula at a much higher rate than did traditional age students, 18 or younger (42 percent versus 29 percent). However, the two age groups did not differ in their rates of completing rigorous high school curricula (18 and 19 percent, respectively).

As levels of family income rose, so did the proportion of students who reported completing rigorous high school curricula. Similarly, as the level of parents' education increased, so did the proportion of students who reported completing rigorous academic curricula.

College Entrance Exam (SAT) Scores

How well students scored on their SAT entrance exams was strongly associated with the level of high school academic curricula they had completed. For example, just 2 percent of students who scored in the lowest SAT quartile had completed rigorous academic curricula, compared with 44 percent who scored in the highest SAT quartile. However, among those who scored in the highest SAT quartile, the likelihood of completing rigorous curricula (44 percent) was no higher than the likelihood of completing mid-level curricula (41 percent).

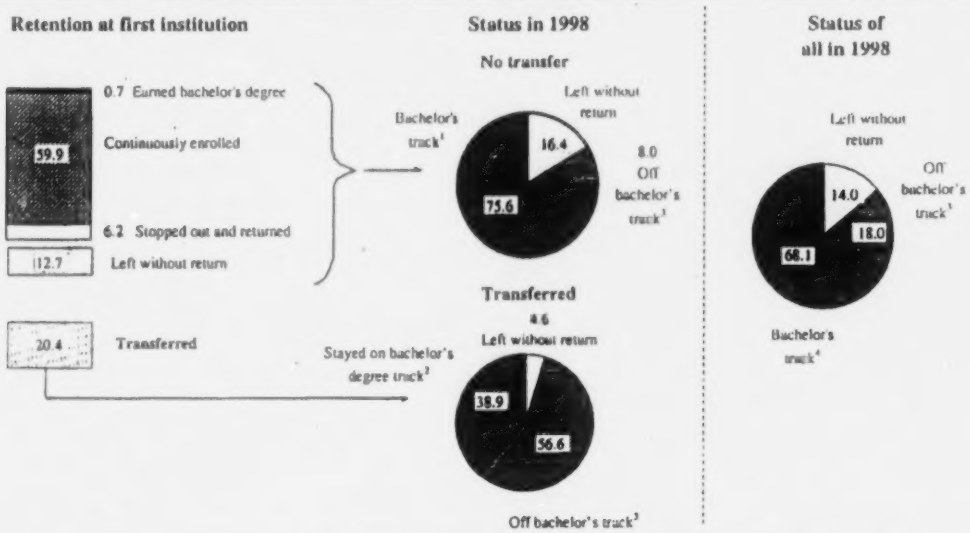
High School Economic Status Indicator

Not all high schools offer the level of courses required to complete a rigorous curriculum. Schools that do not have the financial resources may not be able to offer AP or honors-level courses. This analysis used the proportion of a school's student body eligible for a free or reduced-price lunch as an indicator of the economic status of the high school. Three levels of eligibility were identified: 0–4 percent, 5–24 percent, and 25 percent or more eligible for free or reduced-price lunch. Similar to student socioeconomic indicators (income and parents' education), the high school economic status indicator and the level of academic curriculum students completed exhibited an obvious association. That is, with each successive level of free or reduced-price lunch eligibility, the likelihood of completing a rigorous curriculum declined among 4-year college students who had attended these schools (from 27 to 17 to 11 percent).

Persistence Path Through College

Three years after first entering 4-year institutions in 1995–96, about 60 percent of undergraduates had been continuously enrolled at their first institution (or had attained a degree), 6 percent had left and returned to the same institution, and 20 percent had transferred to another postsecondary institution (figure 2). The remaining 13 percent had left postsecondary education from their first institution without returning. The paths from first enrollment to final enrollment status 3 years later are discussed in the following sections.

Figure 2.—Postsecondary persistence path of 1995–96 beginning students who enrolled in 4-year institutions, 3 years after first enrollment (as of 1998)



[1]Maintained continuous enrollment in first institution or earned a bachelor's degree.
[2]Transferred to a 4-year institution with no break in enrollment.
[3]Stopped out (break of more than 4 months) and/or enrolled in a less-than-4-year institution.
[4]Maintained continuous enrollment in any 4-year institution.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Starting Out

Students' experiences in their first year of college play an important role in the process of persistence (Tinto 1993). Where students begin college, how well they perform in their first year, and their level of involvement in academic activities are important indicators of their likelihood of persisting.

Where They Enroll

High school academic curricula completed by beginning college students were obviously related to where they first enrolled (table 2). For example, just over two-thirds of those who had completed rigorous curricula enrolled in selective 4-year institutions (38 percent in public and 33 percent in private not-for-profit institutions). In contrast, one-third who completed curricula no higher than the core level had enrolled in selective institutions—22 percent in public and 10 percent in private not-for-profit institutions. Those who completed mid-level curricula also were less likely than their counterparts who completed rigorous curricula to attend more selective 4-year institutions, but they were no *more* likely than those in core curricula to do so.

Table 2.—Percentage distribution of institution type where 1995–96 beginning students in 4-year institutions first enrolled, by high school academic curriculum

	Selective[1]		Less-selective[1]	
	Public[2]	Private not-for-profit[3]	Public	Private not-for-profit
Total	25.2	14.9	38.1	21.8
High school academic curriculum				
Core curriculum or less[4]	22.1	10.2	45.1	22.5
Mid-level[5]	27.0	13.1	38.5	21.5
Rigorous[6]	37.7	33.4	15.9	13.0

[1]Selective institutions are identified within Carnegie classifications and are those institutions in which students' average SAT scores exceeded 1000 or Carnegie classifications in which a majority of students were enrolled in very selective institutions. Less-selective institutions are all others not identified in the selective groups.

[2]Public 4-year Research I or II Universities and Baccalaureate I institutions.

[3]Private, not-for-profit 4-year Research I or II Universities, Doctoral I or II Universities, and Baccalaureate I institutions.

[4]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[5]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[6]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Remedial Coursework

Enrollment in remedial courses in the first year of college may reflect students' level of high school academic preparation. Roughly 14 percent of those who began in a 4-year institution reported taking remedial classes in their first year of college (table 3). With each successive level of high school academic curricula, the proportion taking remedial courses declined, from 19 percent of those who completed no higher than core curricula, to 13 percent of those completing mid-level curricula, to 3 percent of those completing rigorous curricula. Examining types of remedial courses taken revealed the same pattern. For example, 13 percent of those completing academic curricula no higher than the core level reported taking remedial mathematics classes, compared with 7 percent of those in mid-level curricula, and 1 percent of those completing rigorous curricula.

Table 3.—Percentage of 1995–96 beginning students in 4-year institutions who reported taking remedial courses in their first year of college, by high school academic curriculum

	Any remedial courses	English language	Mathematics	Reading	Study skills	Writing
Total	13.8	3.7	8.8	4.8	4.1	6.1
High school academic curriculum						
Core curriculum or less[1]	19.3	5.7	13.3	6.9	5.8	8.8
Mid-level[2]	12.8	3.3	7.2	4.0	3.5	5.4
Rigorous[3]	2.7	0.4	1.0	0.9	1.3	2.0

[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.
[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.
[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

First-Year Grades

There was an obvious relationship between students' high school academic curricula and their first-year GPA, especially with respect to the overall average GPA (table 4). That is, with each level of high school academic curricula completed, students' GPA increased (from 2.5 to 2.7 to 3.1). However, the most notable differences occurred between students who had completed rigorous curricula and all others. Differences between students who had completed core curricula or lower and those who had completed mid-level curricula were not as apparent. For example, looking across a distribution of GPA quartiles, the proportions in the lowest quartile (i.e., those

with 2.1 GPAs or lower) did not differ measurably between the two groups (30 percent and 25 percent), but both groups were roughly three times more likely than those who completed rigorous curricula to earn such low GPAs.

Table 4.—Grade-point average (GPA) and percentage distribution of GPA quartiles for 1995–96 beginning students in their first year of college among those enrolled in 4-year institutions, by high school academic curriculum

	Lowest quartile (2.11 or lower)	Middle quartiles (2.12–3.26)	High quartile (3.37 and higher)	Average first-year GPA
Total	24.6	50.2	25.2	2.69
High school academic curriculum				
Core curriculum or less[1]	29.9	50.9	19.2	2.53
Mid-level[2]	24.5	51.5	24.0	2.67
Rigorous[3]	7.8	50.0	42.1	3.10

[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.
[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.
[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Study Groups and Communication With Faculty

Students who are actively involved with other students and who are able to communicate with faculty and advisors outside of class are likely to do better and stay in school than their counterparts who are less involved (Tinto 1993; Pascarella and Terenzini 1977). In this analysis, unlike with GPA and remedial coursework, there was little association between high school academic curricula and the frequency with which students reported participating in study groups or communicating with faculty in their first year of college (table 5). For example, regardless of high school academic curricula, about one-quarter of students reported frequently attending study groups or often talking with faculty outside the classroom. Students who completed rigorous high school curricula were actually less likely than those completing mid-level curricula to report meeting often with an advisor to discuss plans (16 percent versus 23 percent). This may reflect the confidence that those completing rigorous curricula have in their college academic program, relative to their peers reporting less rigorous high school curricula.

Table 5.—Percentage of 1995–96 beginning students who reported frequent participation in various academic activities in their first year in college, among those enrolled in 4-year institutions, by high school academic curriculum

	Attend study groups	Meet with advisor about plans	Talk with faculty outside class
Total	24.6	19.9	24.6
High school academic curriculum			
Core curriculum or less[1]	23.3	19.6	24.2
Mid-level[2]	25.6	22.5	26.4
Rigorous[3]	25.2	16.2	25.2

[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.
[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.
[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

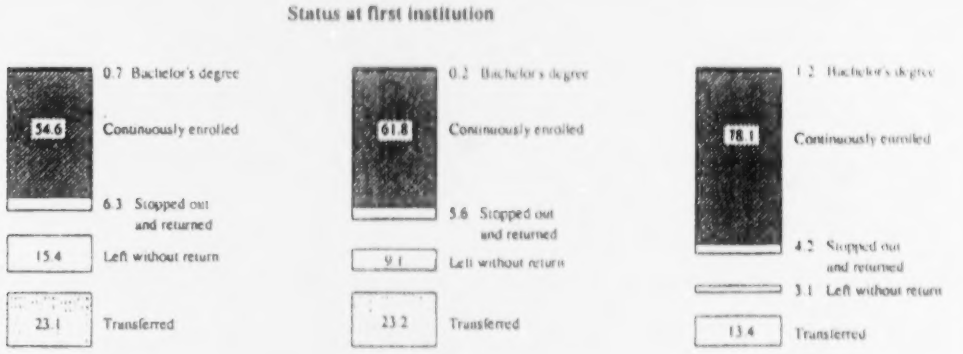
Persistence at First Institution

Three years after first enrolling, 4-year college students' high school curricula was strongly associated with their enrollment status at their first institution (figure 3 and table 6). For example, 78 percent of students who had completed rigorous high school academic curricula had been continuously enrolled in their initial institution, compared with 62 percent and 55 percent, respectively, of those in mid-level or no higher than core curricula. Students who had completed rigorous curricula also were less likely to transfer from their first institution (13 percent) than those who had completed less rigorous programs, whether mid-level or core levels or below (23 percent of both groups transferred).

Staying on Track to a Bachelor's Degree

The difference between levels of academic curricula was especially notable with respect to staying on track to a bachelor's degree (i.e., maintaining continuous enrollment in any 4-year institution). As the level of academic curricula increased, so did the proportion of undergraduates who stayed on track (figure 4). As of 1998, the vast majority of those who had completed rigorous high school academic curricula (87 percent) were still on track to a bachelor's degree, compared with 71 percent of those who had completed mid-level curricula, and 62 percent of those who completed core curricula or lower. Correspondingly, the proportion of those who had left postsecondary education and did not return declined with each successive level of academic curriculum (from 17 percent to 10 percent to 4 percent).

Figure 3.—Percentage distribution of 1995–96 beginning students' 1998 enrollment status in their first institution for those who began in a 4-year institution, by high school academic curriculum



[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.
[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.
[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Table 6.—Percentage distribution by enrollment status in first institution as of 1998, among 1995–96 beginning students who first enrolled in 4-year institutions, by high school academic curriculum

	Bachelor's degree	Continuously enrolled	Stopped out[1] and returned	Continuous transfer	Stopped out[1] and transferred	Left without return
Total	0.7	59.9	6.2	15.2	5.2	12.7
High school academic curriculum						
Core curriculum or less[2]	0.7	54.6	6.3	16.4	6.7	15.4
Mid-level[3]	0.2	61.8	5.6	17.9	5.3	9.1
Rigorous[4]	1.2	78.1	4.2	11.3	2.1	3.1

[1]A stopout is defined as an enrollment break of more than 4 months.
[2]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.
[3]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.
[4]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

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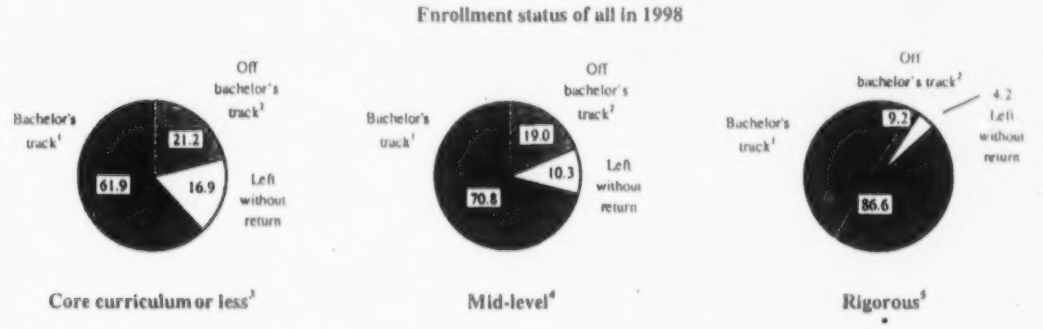
Figure 4.—Enrollment status in 1998 of 1995–96 beginning students who first enrolled in 4-year institutions, by high school academic curriculum



[1]Continuously enrolled in any 4-year institution.

[2]Stopped out (break of 4 or more months) and/or enrolled in a less-than-4-year institution.

[3]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[4]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[5]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Roughly one-fifth of students who had completed less than rigorous academic curricula (19 percent from mid-level and 21 percent from core or lower) had left the bachelor's degree track, but were still enrolled in postsecondary education in 1998. Leaving the track meant they either had a break in enrollment of more than 4 months (stopped out), or they transferred to a less-than-4-year institution. Students completing either mid-level or no higher than core curricula did not differ in their likelihood of leaving the persistence track. In contrast, just 9 percent of those who completed rigorous curricula left the bachelor's degree track.

Transfer Path

While most student departures from postsecondary institutions are not academic dismissals, many voluntary withdrawals occur in anticipation of academic failure, "sometimes in order to transfer to other institutions where academic demands are seen as more reasonable" (Tinto 1993, p. 51). Although the search for a better fit may be the motivation for many of the transfers from 4-year institutions, some studies have shown that any disruption in the educational sequence (including transferring between institutions) may negatively affect degree completion (Pascarella and Terenzini 1991). The findings from this study indicate that, despite transferring, those who completed rigorous academic curricula were likely to stay on track to a bachelor's degree.

Staying on Track to a Bachelor's Degree

As previously noted, the likelihood of transferring from the initial 4-year institution was similar for those completing high school academic curricula no higher than core levels and those completing mid-level curricula. That is, roughly one-quarter in either group had transferred from their first institution, while just 13 percent completing rigorous curricula had done so. However, among transfers, the higher the level of academic curriculum completed in high school, the greater the likelihood of staying on track to a bachelor's degree (figure 5).[7] For those who completed no higher than core curricula, 31 percent of transfers stayed on track to a bachelor's degree, as did 39 percent of transfers who completed mid-level curricula, and 60 percent of transfers who had completed rigorous curricula.

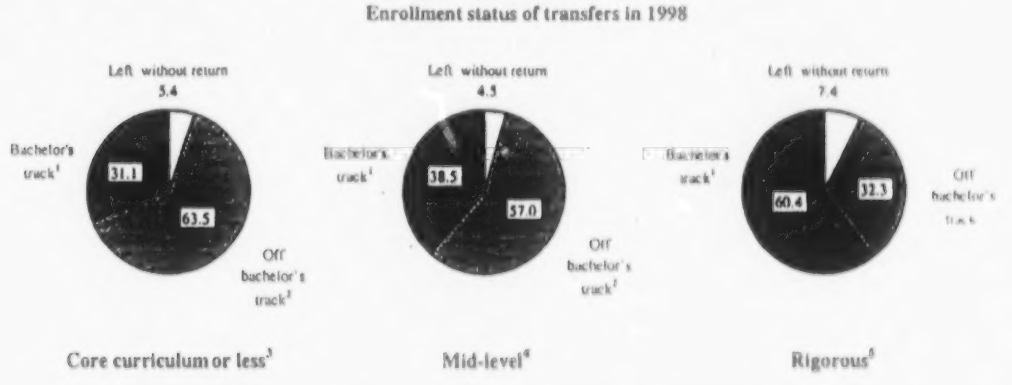
Transfer Destinations

Consistent with McCormick's (1997) research on transfer behavior using the earlier BPS cohort, transfer students were highly likely to leave the 4-year sector. Nearly 40 percent had transferred to a less-than-4-year institution (table 7).[8] However, if transfers had completed a rigorous high school curriculum, they were about half as likely to transfer out of the 4-year sector as their counterparts completing lower levels of academic curricula (21 percent versus 40 to 46 percent).

[7]Those who were off track had a break in enrollment of more than 4 months (stopout) and/or transferred to a less-than-4-year institution or a for-profit 4-year institution.

[8]This group includes a small percentage who transferred to for-profit 4-year institutions.

Figure 5.—For 1995–96 beginning students who transferred from a 4-year institution, percentage distribution of enrollment status in 1998 with respect to earning a bachelor's degree, by high school academic curriculum



[1]Continuously enrolled in any 4-year institution.

[2]Stopped out (break of 4 or more months) and/or enrolled in a less-than-4-year institution.

[3]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[4]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[5]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

By definition, transfers who stay on track to a bachelor's degree transfer to another 4-year institution without a break in enrollment. However, there were differences across high school academic curricula with respect to the selectivity of the institution where they transferred. Among all transfers who completed rigorous high school curricula, 40 percent transferred to a selective institution, compared with just 21 percent and 17 percent of their counterparts who completed either mid-level or no higher than core curricula, respectively. On the other hand, the likelihood of transferring to a less-selective 4-year institution (or for-profit 4-year institution) was similar regardless of academic curricula: just under 40 percent of transfers in each group transferred to less selective 4-year institutions.

Table 7.—Among 1995–96 beginning students who transferred from a 4-year institution, percentage distribution according to their transfer institution, by high school academic curriculum and selectivity of first institution

	Transfer destination		
	4-year institution		Less-than-4-year or for-profit 4-year
	Selective[1]	Less-selective[2]	
	All transfers from 4-year institutions		
Total	21.3	39.5	39.3
High school academic curriculum			
Core curriculum or less[3]	17.4	36.9	45.7
Mid-level[4]	20.9	39.0	40.1
Rigorous[5]	40.4	38.9	20.8
	Began in selective institution		
Total	34.1	30.0	35.9
Core curriculum or less[3]	21.5	31.4	47.1
Mid-level[4]	32.8	27.6	39.6
Rigorous[5]	48.5	32.4	19.1
	Began in less-selective institution		
Total	14.7	44.3	41.0
Core curriculum or less[3]	16.2	38.4	45.4
Mid-level[4]	13.3	46.2	40.5
Rigorous[5]	25.0	50.9	24.0

[1]Selective institutions are public and private not-for-profit institutions in which students' average SAT scores exceeded 1000 or Carnegie classifications in which a majority of students were enrolled in very selective institutions.

[2]Less-selective institutions are all others not identified in the selective groups.

[3]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[4]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[5]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

NOTE: Details may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Examining the selectivity of students' first institution with their second, the likelihood of making a lateral transfer from selective to selective institution was much higher for those completing rigorous high school curricula (49 percent) than for those completing either mid-level curricula (33 percent) or no higher than core curricula (22 percent). Similarly, the likelihood of

transferring from a selective institution to a less-than-4-year or for-profit institution was much lower for those completing rigorous curricula (19 percent) than for their counterparts completing mid-level curricula (40 percent) or no higher than core curricula (47 percent).

While the patterns of transfer appeared to be similar among those who began in less-selective institutions (i.e., those completing rigorous high school curricula more likely than those in less rigorous curricula either to transfer to a selective institution or to transfer laterally, and less likely to transfer to less-than-4-year or for-profit 4-year institutions), there is not enough statistical evidence to draw this conclusion.

Finally, as was shown in figure 5, transfers also left postsecondary education at similar rates no matter what their high school academic program. Approximately 5 percent of students who completed either mid-level or no higher than core curricula had left postsecondary education, as had 7 percent who had completed rigorous curricula.

Reasons Given for Transferring

Students who transferred from their first institutions were asked what their first reason was for leaving. There were few differences in the type of reason reported with respect to high school academic curricula. Reasons that did vary with curricula were related either to academic problems or changing majors or degree programs. As shown in table 8, students who completed mid-level academic curricula were more likely than those who completed rigorous curricula to report academic problems as their first reason for transferring (8 percent versus 2 percent), though the mid-level group did not differ from those who completed no higher than core curricula (5 percent).

As the level of high school academic curricula increased, so did the proportion who reported changing degree programs or majors as their first reason for transferring; 4 percent of transfers who completed no higher than core curricula reported this as their first reason for transferring, as did 10 percent who completed mid-level, and 14 percent who completed rigorous curricula.

Though it appears as though the pattern is reversed for reasons related to location, work, or home demands (i.e., as level of curricula goes up, the frequency of reporting these reasons declines), there was not enough statistical evidence to draw this conclusion.

Table 8.—Among 1995–96 beginning students who transferred from a 4-year institution, the percentage reporting their first reason for leaving, by high school academic curriculum

	Academic problems	Class schedule/ not satisfied with program	Changed degree program or major	Any financial reason	Location/ work/ home demands	Any other or no reason given
Total	6.2	23.3	8.9	18.4	13.6	29.6
High school academic curriculum						
Core curriculum or less[1]	5.0	20.2	3.7	21.5	17.4	32.3
Mid-level[2]	8.0	24.1	10.3	16.9	13.0	27.7
Rigorous[3]	2.3	20.2	13.7	17.0	10.0	36.7

[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Controlling for Related Variables

In addition to high school academic curricula, many other variables may influence postsecondary education outcomes. Therefore, it is necessary to control for their simultaneous effects to determine the net contribution of each variable to the outcome in question. In particular, as was shown in table 1, students' SAT composite scores were highly correlated with their high school academic curricula. Similarly, the likelihood of attending a selective institution was far higher for those completing rigorous academic curricula. Thus, covariance adjustment techniques using simple regression models (see appendix B under "Adjustments of Means to Control for Covariation" for details of method) were used to disentangle the net influence of related independent variables.

Two outcome (dependent) variables were analyzed: (1) continuous enrollment in the initial institution, and (2) staying on track to a bachelor's degree. Each dependent variable was coded as a dichotomous measure (yes/no). Independent variables included in the regression models reflected students' academic experience in high school (academic curricula and college entrance exam scores), demographic characteristics (gender, race/ethnicity, age at college entry), socioeconomic background (income and parents' education), and the economic status of their high schools (as measured by the proportion of students eligible for free or reduced-price lunches). Other variables reflected students' experiences in college, including the type of postsecondary institution in which students first enrolled, enrollment status (full or part time) when they first enrolled, and work status while enrolled. Finally, because independent variables may indirectly affect persistence through an association with college grades, and college grades are a strong predictor of success in college,[9] each regression was run twice, once without and then with first-year GPA (entered as a continuous variable).

Continuous Enrollment at First Institution

The results of the first multivariate analysis are presented in table 9. The first column displays the unadjusted percentages—that is, the proportion of students who stayed continuously enrolled in their initial institution for 3 years. The second column displays the percentages

[9]In research summarized by Pascarella and Terenzini (1991), the authors conclude: "A student's grades are probably the single most revealing indicator of his or her successful adjustment to the intellectual demands of a particular college's course of study ... as a measure of successful adaptation to an academic environment, grades tend to reflect not only requisite intellectual skills, but also desirable personal work habits and attitudes" (p. 388).

Table 9.—Percentage of 1995–96 beginning students in 4-year institutions who were continuously enrolled in their first institution or attained a bachelor's degree as of 1998 and the adjusted percentage after taking into account the covariation of the variables listed in the table

	Unadjusted estimates[1]	Adjusted estimates[2]	Least squares coefficient[3]	Standard error[4]
Total	60.7	60.6	31.5	4.58
High school academic curriculum				
Mid-level[5]	62.1*	59.8	3.4	2.34
Rigorous[6]	79.3*	70.1*	13.7	3.30
Core curriculum or less[7]	*55.3*	*56.4*	†	†
Derived SAT combined score				
Lowest quartile (400–790)	48.5*	53.6*	-7.7	2.75
Highest quartile (1100–1600)	74.8*	65.6	4.3	2.71
Middle quartiles (800–1090)	*63.4*	*61.3*	†	†
Gender				
Female	61.6*	61.8	2.5	2.03
Male	*59.5*	*59.3*	†	†
Race/ethnicity				
American Indian/Alaskan Native	74.1	77.1	16.8	12.74
Asian/Pacific Islander	69.2	65.3	5.0	4.35
Hispanic	58.2	62.4	2.1	3.28
Black, non-Hispanic	50.2*	57.6	-2.7	3.62
White, non-Hispanic	*61.6*	*60.3*	†	†
Family income in 1994				
Low income	51.5*	57.4	-3.9	2.94
Middle income or high income	*62.6*	*61.3*	†	†
Parents' highest education				
High school or less	51.2*	56.8*	-5.9	2.26
Attended college or higher	*64.4*	*62.7*	†	†
Free or reduced-price lunch eligibility at high school				
25 percent or higher	58.2*	60.7	0.1	2.20
0–24 percent	*64.3*	*60.6*	†	†
First 4-year institution[8]				
Public selective[9]	69.8*	65.1*	7.2	2.75
Private not-for-profit selective[10]	71.7*	63.9	6.0	3.39
Private not-for-profit less-selective	55.3	58.2	0.3	2.73
Public less-selective	*53.3*	*57.9*	†	†
Attendance status first enrolled				
Full time	62.9*	61.9*	13.0	3.62
Part time	*40.1*	*49.0*	†	†

Table 9—Percentage of 1995–96 beginning students in 4-year institutions who were continuously enrolled in their first institution or attained a bachelor's degree as of 1998 and the adjusted percentage after taking into account the covariation of the variables listed in the table—Continued

	Unadjusted estimates[1]	Adjusted estimates[2]	Least squares coefficient[3]	Standard error[4]
Hours worked when first enrolled				
Did not work	66.3*	63.5*	15.0	3.73
Part time	62.0*	61.1*	12.5	3.58
Full time	*42.1*	*48.6*	†	†

*p<0.05.

†Not applicable for the reference group.

[1]The estimates are from the BPS:96/98 Data Analysis System.

[2]The percentages are adjusted for differences associated with other variables in the table (see appendix B).

[3]Least squares coefficient multiplied by 100 to reflect percentage (see appendix B).

[4]Standard error of least squares coefficient, adjusted for design effect multiplied by 100 to reflect percentage (see appendix B).

[5]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[6]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

[7]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[8]Selective institutions are identified within Carnegie classifications and are those institutions in which students' average SAT scores exceeded 1000 or Carnegie classifications in which a majority of students were enrolled in very selective institutions. Less-selective institutions are all others not identified in the selective groups.

[9]Public 4-year Research I or II Universities and Baccalaureate I institutions.

[10]Private, not-for-profit 4-year Research I or II Universities, Doctoral I or II Universities, and Baccalaureate I institutions.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

after adjusting for the covariation among all the independent variables listed in the table. In other words, the second column shows the net influence of each independent variable, once other variables are taken into account. The italicized category for each variable is the reference group against which all comparisons and tests of statistical significance are made. Asterisks indicate when a particular category of a variable differs significantly from the reference group. If asterisks appear in both columns, it means that even after controlling for related variables, a particular variable is associated with the outcome. For example, students who began in selective public institutions were more likely to stay continuously enrolled for 3 years than students who began in less-selective public institutions (comparison group). This remained true after adjusting for the covariation of related variables.

The multivariate results demonstrate a distinct advantage that students who completed rigorous high school curricula held over those who completed no higher than core curricula (the comparison group). That is, after controlling for demographic characteristics, high school socioeconomic status, SAT scores, and other related variables, students who completed rigorous high

school academic curricula were more likely to remain continuously enrolled at their first institution than those who completed no higher than core curricula. Students who completed mid-level curricula, on the other hand, did not differ measurably in their likelihood of staying enrolled at their first institution from their counterparts who completed core curricula or lower.

Other independent variables associated with persistence at the first institution after covariance adjustment included parents' education (those whose parents completed no higher than a high school education were less likely to stay continuously enrolled than their peers whose parents attended college),[10] attendance status when first enrolled (students who enrolled full time were much more likely to stay continuously enrolled than those who began part time), employment while enrolled (students who were working full time when they began college were less likely to stay continuously enrolled than those working part time or not working), and SAT scores (those scoring in the lowest quartile were less likely to stay continuously enrolled than those scoring higher).

Table 10 shows the results of the same means adjustment analysis after including first-year GPA as an independent continuous variable in the regression model. Students' high school academic curricula continued to play a role in persistence at the first institution even when GPA was taken into account. Students who completed rigorous high school curricula were still more likely to stay continuously enrolled in their first institution than those who completed curricula no higher than core levels. Similarly, all the other variables that had been significant before adding GPA as an independent variable (i.e., adjusted estimates in table 9), remained significant after GPA was added with the exception of SAT scores. SAT scores no longer had a direct association with persistence at the first institution (adjusted estimates in table 10).

Staying on Track to a Bachelor's Degree

When examining the likelihood of staying on track to a bachelor's degree (which includes transfer students), high school curriculum appeared to play an even stronger role in predicting persistence at first institution (table 11). That is, students who completed either rigorous high school curricula *or* those who completed mid-level curricula were more likely to stay on track to a bachelor's degree than their counterparts who completed no higher than core curricula. In other words, when transfers were included in the outcome, those who completed mid-level academic curricula held an advantage over those who completed no higher than core curricula.

[10] A recent NCES report provides a detailed analysis of the experiences of "first-generation" college students—those whose parents did not attend college (Warburton, Bugarin, and Nuñez 2001).

Table 10.—Percentage of 1995–96 beginning students in 4-year institutions who were continuously enrolled in their first institution or attained a bachelor's degree as of 1998 and the adjusted percentage after taking into account the covariation of the variables listed in the table, controlling for first-year college GPA

	Unadjusted estimates[1]	Adjusted estimates[2]	Least squares coefficient[3]	Standard error[4]
		Controlling for GPA[5]		
Total	60.7	60.6	-12.2	5.08
High school academic curriculum				
Mid-level curriculum[6]	62.1*	60.3	2.2	2.21
Rigorous[7]	79.3*	66.0*	7.9	3.13
Core curriculum or less[8]	*55.3*	*58.0*	†	†
Derived SAT combined score				
Lowest quartile (400–790)	48.5*	61.2	-0.2	2.63
Highest quartile (1100–1600)	74.8*	58.4	-3.0	2.59
Middle quartiles (800–1090)	*63.4*	*61.4*	†	†
Gender				
Female	61.6*	59.8	-1.9	1.93
Male	*59.5*	*61.7*	†	†
Race/ethnicity				
American Indian/Alaskan Native	74.1	69.8	10.3	12.03
Asian/Pacific Islander	69.2	65.4	5.9	4.11
Hispanic	58.2	64.7	5.2	3.10
Black, non-Hispanic	50.2*	62.1	2.7	3.43
White, non-Hispanic	*61.6*	*59.5*	†	†
Family income in 1994				
Low income	51.5*	57.6	-3.6	2.78
Middle income or high income	*62.6*	*61.2*	†	†
Parents' highest education				
High school or less	51.2*	56.9*	-5.8	2.13
Attended college or higher	*64.4*	*62.7*	†	†
Free or reduced-price lunch eligibility at high school				
25 percent or higher	58.2*	60.7	0.1	2.08
0–24 percent	*64.3*	*60.6*	†	†
First 4-year institution[9]				
Public selective[10]	69.8*	65.6*	7.0	2.59
Private not-for-profit selective[11]	71.7*	64.2	5.6	3.20
Private not-for-profit less-selective	55.3	56.1	-2.5	2.58
Public less-selective	*53.3*	*58.6*	†	†
Attendance status first enrolled				
Full time	62.9*	61.9*	13.0	3.41
Part time	*40.1*	*49.0*	†	†

Table 10.—Percentage of 1995–96 beginning students in 4-year institutions who were continuously enrolled in their first institution or attained a bachelor's degree as of 1998 and the adjusted percentage after taking into account the covariation of the variables listed in the table, controlling for first-year college GPA—Continued

	Unadjusted estimates[1]	Adjusted estimates[2]	Least squares coefficient[3]	Standard error[4]
		Controlling for GPA[5]		
Hours worked when first enrolled				
Did not work	66.3*	63.0*	12.7	3.52
Part time	62.0*	61.1*	10.7	3.38
Full time	*42.1*	*50.3*	†	†

*p<0.05.

†Not applicable for the reference group.

[1]The estimates are from the BPS:96/98 Data Analysis System.

[2]The percentages are adjusted for differences associated with other variables in the table (see appendix B).

[3]Least squares coefficient multiplied by 100 to reflect percentage (see appendix B).

[4]Standard error of least squares coefficient, adjusted for design effect multiplied by 100 to reflect percentage (see appendix B).

[5]Added as a continuous independent variable simultaneously with all other independent variables.

[6]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[7]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

[8]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[9]Selective institutions are identified within Carnegie classifications and are those institutions in which students' average SAT scores exceeded 1000 or Carnegie classifications in which a majority of students were enrolled in very selective institutions. Less-selective institutions are all others not identified in the selective groups.

[10]Public 4-year Research I or II Universities and Baccalaureate I institutions.

[11]Private, not-for-profit 4-year Research I or II Universities, Doctoral I or II Universities, and Baccalaureate I institutions.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Prior to adding GPA into the regression model, SAT scores also predicted staying on track to a bachelor's degree. However, as shown in table 12, once GPA was taken into account, SAT scores were no longer associated with staying on track to a bachelor's degree. High school curricula, on the other hand, remained a significant predictor of staying on track to a bachelor's degree. However, the difference between the completing mid-level curricula and completing curricula no higher than core levels did not reach statistical significance.[11]

Many of the same variables that were important for predicting persistence at first institution remained significant for predicting the likelihood of staying on track to a bachelor's degree (both

[11]Prior to adjusting the standard error for the design effect of the dependent variable, the two groups (mid-level and core curricula) were significantly different in their rate of staying on track to a bachelor's degree, but after adjusting for the design effect, the difference did not reach statistical significance (t=1.90). See appendix B for a description the design effect adjustment procedure.

Table 11.—Percentage of 1995–96 beginning students in 4-year institutions who remained on bachelor's degree track as of 1998 and the adjusted percentage after taking into account the covariation of the variables listed in the table

	Unadjusted estimates[1]	Adjusted estimates[2]	Least squares coefficient[3]	Standard error[4]
Total	68.1	68.1	30.8	4.24
High school academic curriculum				
Mid-level curriculum[5]	70.8*	68.1*	5.0	2.16
Rigorous[6]	86.6*	76.4*	13.4	3.05
Core curriculum or less[7]	*61.9*	*63.0*	†	†
Derived SAT combined score				
Lowest quartile (400–790)	54.9*	59.9*	-9.1	2.54
Highest quartile (1100–1600)	82.7*	73.4	4.3	2.50
Middle quartiles (800–1090)	*71.6*	*69.0*	†	†
Gender				
Female	70.2*	70.3*	5.0	1.88
Male	*65.5*	*65.3*	†	†
Race/ethnicity				
American Indian/Alaskan Native	82.1	88.7	21.0	11.80
Asian/Pacific Islander	74.6	71.1	3.4	4.03
Hispanic	66.1	70.7	3.0	3.03
Black, non-Hispanic	56.4*	64.8	-2.9	3.35
White, non-Hispanic	*69.2*	*67.7*	†	†
Family income in 1994				
Low income	57.8*	64.6	-4.1	2.72
Middle income or high income	*70.3*	*68.7*	†	†
Parents' highest education				
High school or less	57.4*	63.7*	-6.7	2.09
Attended college or higher	*72.5*	*70.4*	†	†
Free or reduced-price lunch eligibility at high school				
25 percent or higher	63.8*	70.1	3.2	2.04
0–24 percent	*73.0*	*66.9*	†	†
First 4-year institution[8]				
Public selective[9]	75.5*	70.4	4.8	2.54
Private not-for-profit selective[10]	81.6*	72.7*	7.0	3.14
Private not-for-profit less-selective	63.7	66.4	0.8	2.53
Public less-selective	*60.4*	*65.7*	†	†
Attendance status first enrolled				
Full time	70.7*	69.5*	14.9	3.35
Part time	*43.7*	*54.6*	†	†

Table 11—Percentage of 1995–96 beginning students in 4-year institutions who remained on bachelor's degree track as of 1998 and the adjusted percentage after taking into account the covariation of variables listed in the table—Continued

	Unadjusted estimates[1]	Adjusted estimates[2]	Least squares coefficient[3]	Standard error[4]
Hours worked when first enrolled				
Did not work	74.1*	71.5*	19.3	3.45
Part time	69.8*	68.9*	16.8	3.31
Full time	*44.9*	*52.1*	†	†

*p<0.05.

†Not applicable for the reference group.

[1]The estimates are from the BPS:96/98 Data Analysis System.

[2]The percentages are adjusted for differences associated with other variables in the table (see appendix B).

[3]Least squares coefficient multiplied by 100 to reflect percentage (see appendix B).

[4]Standard error of least squares coefficient, adjusted for design effect multiplied by 100 to reflect percentage (see appendix B).

[5]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[6]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

[7]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[8]Selective institutions are identified within Carnegie classifications and are those institutions in which students' average SAT scores exceeded 1000 or Carnegie classifications in which a majority of students were enrolled in very selective institutions. Less-selective institutions are all others not identified in the selective groups.

[9]Public 4-year Research I or II Universities and Baccalaureate I institutions.

[10]Private, not-for-profit 4-year Research I or II Universities, Doctoral I or II Universities, and Baccalaureate I institutions.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

before and after adding GPA). For example, the disadvantage of starting college either attending part time (versus full time) or working full time (versus part time or not working) remained pronounced for staying on track to a bachelor's degree. Similarly, students whose parents did not pursue an education beyond high school were less likely to stay on track than those whose parents attended college.

On the other hand, the influence of first institution type on the rate of staying on track to a bachelor's degree changed. In predicting whether or not students remained continuously enrolled at their first institution, attending a public selective institution (versus a public less-selective institution) produced a higher rate of persistence, while the rate for those starting in selective private not-for-profit institutions did not appear to differ from the rate of those in public less-selective institutions. Staying on track to bachelor's degree on the other hand, was more likely to occur for those who began in a selective private not-for-profit institution (versus public less-selective), while the rate for those who began in public selective institutions did not appear to differ from that of their counterparts in public less-selective institutions.

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Table 12.—Percentage of 1995–96 beginning students in 4-year institutions who remained on bachelor's degree track as of 1998 and the adjusted percentage after taking into account the covariation of the variables listed in the table, controlling for first-year college GPA

	Unadjusted estimates[1]	Adjusted estimates[2]	Least squares coefficient[3]	Standard error[4]
		Controlling for GPA[5]		
Total	68.1	68.1	-15.8	4.62
High school academic curriculum				
Mid-level curriculum[6]	70.8*	68.6	3.8	2.01
Rigorous[7]	86.6*	72.1*	7.3	2.85
Core curriculum or less[8]	*61.9*	*64.8*	†	†
Derived SAT combined score				
Lowest quartile (400–790)	54.9*	68.1	-1.1	2.39
Highest quartile (1100–1600)	82.7*	65.6	-3.5	2.36
Middle quartiles (800–1090)	*71.6*	*69.1*	†	†
Gender				
Female	70.2*	68.2	0.3	1.76
Male	*65.5*	*67.9*	†	†
Race/ethnicity				
American Indian/Alaskan Native	82.1	80.9	14.1	10.94
Asian/Pacific Islander	74.6	71.1	4.3	3.73
Hispanic	66.1	73.1*	6.4	2.82
Black, non-Hispanic	56.4*	69.6	2.8	3.12
White, non-Hispanic	*69.2*	*66.8*	†	†
Family income in 1994				
Low income	57.8*	64.8	-3.8	2.52
Middle income or high income	*70.3*	*68.7*	†	†
Parents' highest education				
High school or less	57.4*	63.8*	-6.6	1.94
Attended college or higher	*72.5*	*70.4*	†	†
Free or reduced-price lunch eligibility at high school				
25 percent or higher	63.8*	70.1	3.2	1.89
0–24 percent	*73.0*	*66.9*	†	†
First 4-year institution[9]				
Public selective[10]	75.5*	71.0	4.6	2.36
Private not-for-profit selective[11]	81.6*	73.0*	6.6	2.91
Private not-for-profit less-selective	63.7	64.2	-2.2	2.35
Public less-selective	*60.4*	*66.4*	†	†
Attendance status first enrolled				
Full time	70.7*	69.5*	15.0	3.10
Part time	*43.7*	*54.6*	†	†

Table 12—Percentage of 1995–96 beginning students in 4-year institutions who remained on bachelor's degree track as of 1998 and the adjusted percentage after taking into account the covariation of the variables listed in the table, controlling for first-year college GPA—Continued

	Unadjusted estimates[1]	Adjusted estimates[2]	Least squares coefficient[3]	Standard error[4]
		Controlling for GPA[5]		
Hours worked when first enrolled				
Did not work	74.1*	71.0*	17.0	3.20
Part time	69.8*	68.9*	14.9	3.07
Full time	*44.9*	*54.0*	†	†

*p<0.05.

†Not applicable for the reference group.

[1]The estimates are from the BPS:96/98 Data Analysis System.

[2]The percentages are adjusted for differences associated with other variables in the table (see appendix B).

[3]Least squares coefficient multiplied by 100 to reflect percentage (see appendix B).

[4]Standard error of least squares coefficient, adjusted for design effect multiplied by 100 to reflect percentage (see appendix B).

[5]Added as a continuous independent variable simultaneously with all other independent variables.

[6]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[7]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

[8]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[9]Selective institutions are identified within Carnegie classifications and are those institutions in which students' average SAT scores exceeded 1000 or Carnegie classifications in which a majority of students were enrolled in very selective institutions. Less-selective institutions are all others not identified in the selective groups.

[10]Public 4-year Research I or II Universities and Baccalaureate I institutions.

[11]Private, not-for-profit 4-year Research I or II Universities, Doctoral I or II Universities, and Baccalaureate I institutions.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

With respect to students' background characteristics, there were no gender or racial/ethnic differences in the rates of persistence at first institution, but the same was not true for staying on track to a bachelor's degree. Prior to controlling for GPA, women were more likely than men to stay on track, but differences by race/ethnicity were not significant. After controlling for GPA, the gender difference disappeared, but Hispanic students' rate of staying on track was higher than that of White students. It is not clear why differences by gender and race/ethnicity should not have been the same for both measures of persistence (i.e., institutional retention and bachelor's degree persistence track).

Summary and Conclusions

The findings of this study demonstrated a consistent advantage experienced by students who completed rigorous high school curricula—and to a lesser extent by those completing mid-level academic curricula—over their peers in core curricula or lower. Those who completed rigorous curricula were more likely to stay enrolled in their first institution or, if they transferred, to stay on track to a bachelor's degree.

It stands to reason that the level of coursework completed by students in high school would be associated in part with their early education and opportunities to take advanced coursework. In this study, students from low-income families, those whose parents attained no higher than a high school education, and those who attended high schools in which a large proportion of the students were eligible for free or reduced-price lunches all were less likely to have completed a rigorous high school academic curriculum than their more advantaged counterparts. It also stands to reason that students who complete a rigorous curriculum would score higher on their college entrance exams, enroll in more selective colleges and universities, and earn higher grades in their first year of college. All of these associations were demonstrated in this study. Yet, once all such related variables were taken into consideration, high school academic curriculum continued to play a role in how well students persisted toward their college degree. For both measures of persistence—staying continuously enrolled in the same institution (institutional retention) and staying on track to a bachelor's degree if they transferred—students who completed a rigorous high school curriculum did better than those who completed no higher then core curricula. This finding held even when controlling for socioeconomic background, college admission exam scores, the type of college students first attended, how well they did in their first year, and other variables known to be associated with college persistence and degree attainment.

Before taking first-year college GPA into account, both high school curriculum and levels of SAT scores were related to persistence. However, after GPA was taken into consideration, high school curriculum remained a significant factor, while SAT scores did not. These findings are consistent with Adelman's (1999) research on determinants of degree attainment. His findings demonstrated that high school curriculum was a stronger predictor of bachelor's degree attainment than standardized test scores or other measures of high school academic performance, leading the author to conclude:

> When academic intensity and quality of one's high school curriculum is such a dominant determinant of degree completion, and both test scores and (especially) high school grade point average or class rank are so much weaker contributors to attainment, college admission formulas that emphasize test scores and (especially) high school grade point average or class rank are likely to result in lower degree completion rates. (Adelman 1999, p. ix)

In the current study, the benefit of a strong high school academic curriculum was particularly noteworthy for transfer students. Students who transfer from their initial 4-year college may be struggling either academically or socially, and attempting to find a better fit in another institution. Among students who first enrolled in college in 1995–96, one-fifth had transferred as of 1998. For these students in particular, as their level of high school academic curriculum increased, so did their likelihood of staying on track to a bachelor's degree (by transferring to another 4-year institution without a break in enrollment).

Taken together, the results suggest that completing a rigorous academic curriculum in high school may help students overcome socioeconomic disadvantages such as low family income and parents with no college experience, as well as helping those who, for whatever reason, decide to transfer to another institution.

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Appendix A—Glossary

This glossary describes the variables used in this report. The items were taken directly from the Beginning Postsecondary Students Longitudinal Study First Follow-up (BPS:96/98) Data Analysis System (DAS), which is the NCES software application that generates tables from BPS:96/98. A description of the DAS software can be found in appendix B. The variable names are in capital letters and correspond to the names of the variables in the DAS. In the index below, the variables in each section are listed in the order they appear in the report; the glossary is in alphabetical order by variable name (displayed in the right-hand column).

Glossary Index

Demographic Characteristics

Gender ..... SBGENDER
Race/ethnicity SBRACEC1
Parents' highest education PBEDHI3
Family income in 1994 ..... SFPOV3
Age first enrolled in postsecondary education ..... SBAGEFM

High School Variables

Academic curriculum ..... CTAKING
Average SAT I (or equivalent ACT) composite score ..... TESATDER
Percentage eligible for free or reduced-price lunch HSLUNCH2

Postsecondary Institutions and Experiences

Type of initial institution ITCARCT3
Type of transfer destination institution ITCARCT4
Employment status when first enrolled J1HOUR
First-year grade-point average (GPA) SEGPAY1
First reported reason for transferring RTFIRSB1

Remedial Courses

Any remedial courses REMED2
English language ..... SILANG
Math ..... SIMATH
Reading ..... SIREAD
Study Skills ..... SISTUD
Writing ..... SISWRIT

Academic Activities in First Year of College

Attend study group outside of class ..... CMSTUDGP
Meet with advisor about plans ..... CMMEET
Talk with faculty outside of class ..... CMTALK

Postsecondary Persistence

Persistence at first institution PRSIB1
Persistence track to bachelor's degree PRFLTYB1

Meet with advisor about plans **CMMEET**

Response to question: "Please tell me how often you participated in the activity. Talk with faculty about academic matters outside of class time (never, sometimes, often)"? For this analysis, only those who responded "often" were identified.

Talk with faculty outside of class **CMTALK**

Response to question: "Please tell me how often you participated in the activity. Meet with advisor concerning academic plans (never, sometimes, often)"? For this analysis, only those who responded "often" were identified.

Attend study group outside of class **CMSTUDGP**

Response to question: "Please tell me how often you participated in the activity. Attend study groups outside of the classroom (never, sometimes, often)"? For this analysis, only those who responded "often" were identified.

High school academic curriculum **CTAKING**

Academic curriculum based on courses reported taken or planned to take by respondents when they applied to take the SAT I or ACT Assessment. There were approximately 22 percent of 4-year students with missing data for the curriculum variable either because of missing course-taking data items or because they did not take the SAT exam in the time period for which the data were collected. Missing cases were more likely to be older, independent students who might have taken the SAT exams much earlier.

Core curriculum or lower	Completed no more than 4 years of English, 3 years each of social science, mathematics, science.
Mid-level I	4 years of English; 1 year of a foreign language; 3 years each of mathematics and science including two of the following science courses: biology, chemistry, and physics.
Mid-level II	4 years of English; 2 years of a foreign language; 3 years each of mathematics (including Algebra II) and science (including biology, chemistry, and physics).
Rigorous	4 years of each English and mathematics (including precalculus or higher); 3 years each of a foreign language, science (including biology, chemistry, and physics), social science; one AP or honors class or AP test score in any subject.

For this analysis, the middle two groups were combined into one mid-level category.

Percentage eligible for free or reduced-price lunch **HSLUNCH2**

Indicates the percentage of respondents' high school student body eligible for free or reduced-price lunches if they graduated from a public school. If student graduated from a private high school, it was assumed that no students were eligible for free or reduced-price lunch.

0 to 4 percent	Up to 4 percent eligible for free or reduced-price lunch in public school (includes all private schools).
5 to 24 percent	5 to 24 percent eligible for free or reduced-price lunch
25 percent or more	25 percent of more eligible for free or reduced-price lunch.

Type of initial institution **ITCARCT3**

Identifies the first institution attended by respondent, by selectivity within control and 1994 Carnegie classification. The Carnegie classification system includes all colleges and universities in the United States that are degree granting and accredited by an agency recognized by the U.S. Secretary of Education. In this study, selective institutions were identified as Carnegie classifications in which the average SAT scores of beginning students exceeded 1000 or in which a majority of students were enrolled in very selective institutions (institutions in which 75 percent of students scored 1000 or higher on the SAT exam as identified in the Common Data Set[12]). The classifications differ for public and private not-for-profit institutions (see table below for details).

Public selective	Institutions classified as Research University I and II, and Baccalaureate I
Public less-selective	All other public 4-year institutions
Private not-for-profit selective	Research University I and II, Doctoral University I and II, and Baccalaureate I
Private not-for-profit less-selective	All other private not-for-profit 4-year institutions

[12]The Common Data Set is an institutional data collection sponsored by a collaboration of The College Board, Peterson's, *U.S. News & World Report*, and Wintergreen/Orchard House. Fall 1997 rather than fall 1996 data were used because more institutions participated and provided more complete responses in the latter year. Although there is a 2-year interval between the college entry of BPS:96/98 freshmen and fall 1997 institutional data, any change in an institution's admission test score distribution would have been unlikely to have affected its selectivity classification for this study.

Carnegie Classifications meeting selective criteria* (in bold)

	Derived SAT combined score for full-time 4-year students	Percent of students in very selective institutions		Derived SAT combined score for full-time 4-year students	Percent of students in very selective institutions
	Public institutions			Private not-for-profit institutions	
Total	937	23.6		986	33.1
Carnegie classification					
Research I and II	1,025	49.3	**Research I and II**	**1,154**	**92.1**
Doctoral I	935	13.5	**Doctoral I**	**1,022**	**59.7**
Doctoral II	871	13.3	**Doctoral II**	**1,042**	**65.1**
Comprehensive	854	1.7	Comprehensive	930	18.1
Baccalaureate I	995	100.0	**Baccalaureate I**	**1,094**	47.3
Baccalaureate II	834	0.0	Baccalaureate II	848	0.0
All others	803	0.0	All others	873	0.0

*Average SAT score of beginning students was over 1000 or a majority of students were enrolled in very selective institutions (25th percentile of SAT score 1000 or higher).

SOURCE: U.S. Department of Education. National Center for Education Statistics. 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

Type of transfer destination institution **ITCARCT4**

Identifies the second institution attended by respondents who transferred, by control and Carnegie Classification. See ITCARCT3 (above) for classification of 4-year transfer institutions. In addition, a fifth category was added for less-than-4-year institutions (such as community colleges or trade schools) and for-profit 4-year institutions.

Employment status when first enrolled **J1HOUR**

Indicates the number of hours worked while enrolled in 1995–96.

Did not work while enrolled	
Worked part time	Worked less than 35 hours
Worked full time	Worked 35 or more hours

Parents' highest education **PBEDHI3**

Indicates the highest education level attained by either parent of the respondent.

High school or lower	Parent had less than a high school education or a high school diploma.
Some college	Parent went to trade school, had less than 2 years of college, or had 2 or more years of college.

Bachelor's or advanced degree	Parent earned a bachelor's degree or postgraduate/professional degree.

Persistence track to bachelor's degree **PRFLTYB1**

Identifies the type of first departure from the persistence track. Responses were categorized as follows:

Did not leave track	Respondents stayed continuously enrolled in any 4-year institution through 1998.
Left track, still enrolled	Respondents left persistence track by a break in enrollment of more than 4 months (stopout), or transferring to a less-than-4-year institution.
Left without return	Respondents left without return to postsecondary education.

Persistence at first institution **PRSIB1**

Identifies the outcome of the first spell of continuous enrollment at the first institution. For those who attained a degree prior to the spell end, the variable identifies the degree attained. For those who did not attain prior to the spell end, the variable distinguishes whether the student was still enrolled at the first institution in Spring 1998, experienced a stopout and returned to the institution, experienced a stopout and enrolled at new institution, experienced an immediate transfer to a new institution, or left postsecondary education without return at the end of the spell. Responses were grouped as follows:

Continuous enrollment, no transfer, attained BA
Continuous enrollment as of 1998
No degree, stopout, returned to institution (stopout return)
No degree, stopout, enroll at new institution (stopout transfer)
No degree, continuous enrollment, enrolled at new institution (continuous transfer)
No degree, left without return

For the multivariate analysis, the first two categories of continuous enrollment were used as the dependent variable indicating persistence at the first institution. In some cases the two transfer groups (stopout transfer and continuous transfer) were combined.

Any remedial courses **REMED2**

Indicates whether student reported taking any remedial or developmental course in language, math, reading, or writing in 1995–96. NOTE: Does not include courses in study skills.

First reported reason for transferring **RTFIRSB1**

Indicates the first reason for transfer based on the interview question: Why did you decide to leave the [sampled] institution? Reasons were coded as follows:

Academic problems/reasons	Includes academic problems; transfer school is less competitive; school/program closed/lost accreditation; completed the desired class.

Class schedule/ not satisfied	Student reported that classes were not available, had scheduling problems, or was not satisfied with program/institution.
Changed degree program/major/field	Student reported he/she either changed major or degree program.
Financial reasons	Student reported any financial reasons for transferring.
Location or home demands	Respondent moved from the area and or reported other/personal reasons which include: conflicts with job/military; change in family status (e.g., marriage); conflicts with demands at home.
Other reasons or none	Any reason other than those listed above or no reported reason for transferring.

Gender **SBGENDER**

Male
Female

Race/ethnicity **SBRACECI**

Indicates the race/ethnicity of respondents who were U.S. citizens and permanent residents. Racial/ethnic groups were defined as follows:

White, non-Hispanic	Respondent has origins in any of the original peoples of Europe, North Africa, or the Middle East (except those of Hispanic origin).
Black, non-Hispanic	Respondent has origins in any of the black racial groups of Africa, not of Hispanic origin.
Hispanic	Respondent is Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.
Asian/Pacific Islander	Respondent has origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or Pacific Islands. This includes people from China, Japan, Korea, the Philippine Islands, Samoa, India, and Vietnam.
American Indian/Alaskan Native	Respondent has origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition.

Age first enrolled in postsecondary education **SBAGEFM**

Indicates the respondent's age when first enrolled at 1995–96 postsecondary institution. Age was defined in the following categories:

18 years or younger
19 or older

First-year grade-point average (GPA) **SEGPAY1**

Indicates the average student GPA (standardized to a 4.00 point scale) as reported by the institution. Scores were grouped as follows:

Lowest quartile	Less than 2.10
Middle quartiles	2.11–3.26
Highest quartile	3.27–4.00

In some cases, the average GPA was reported.

English language **SILANG**

Students who indicated that they took any remedial or developmental courses in 1995–96 were asked if specific courses were in the following:

Reading	(SIREAD)
Writing	(SIWRIT)
Math	(SIMATH)
Study Skills	(SISTUD)
English language skills	(SILANG)

This variable indicates whether student took a remedial course in English.

Math **SIMATH**

Indicates whether student took a remedial course in math. For more detailed information, see SILANG.

Reading **SIREAD**

Indicates whether student took a remedial course in reading. For more detailed information, see SILANG.

Study skills **SISTUD**

Indicates whether student took a remedial course in study skills. For more detailed information, see SILANG.

Writing **SISWRIT**

Indicates whether student took a remedial course in writing. For more detailed information, see SILANG.

Family income in 1994 **SFPOV3**

Total 1994 income as a percentage of the federal poverty level thresholds for 1994. Based on family size, total income, and dependency. Refers to the family of the parents of dependent students and the student's own family if independent.

Low income	Below 125 percent of poverty level
Middle income	125 to 634 percent above poverty level
High income	635 percent or more above poverty level

Average SAT I (or equivalent ACT) composite score **TESATDER**

Indicates respondent's derived SAT I original scale combined score as either the sum of SAT I verbal and math scores or the ACT Assessment composite score converted to an estimated SAT I combined score. Scores were combined as follows:

Lowest quartile	400–790
Middle quartiles	800–1090
Highest quartile	1100 or above

Appendix B—Technical Notes and Methodology

The Beginning Postsecondary Students Longitudinal Study (BPS:96/98)

The Beginning Postsecondary Students Longitudinal Study (BPS) is composed of the students who participated in the 1995–96 National Postsecondary Student Aid Study (NPSAS:96) who enrolled in postsecondary education for the first time in 1995–96. The National Postsecondary Student Aid Study (NPSAS) is a comprehensive nationwide study conducted by the U.S. Department of Education's National Center for Education Statistics (NCES) to determine how students and their families pay for postsecondary education.[13] It also describes demographic and other characteristics of students enrolled. The study is based on a nationally representative sample of all students in postsecondary education institutions, including undergraduate, graduate, and first-professional students. For NPSAS:96, information was obtained from more than 830 postsecondary institutions on approximately 44,500 undergraduate, 8,700 graduate, and 2,500 first-professional students. They represented about 16.7 million undergraduates, 2.4 million graduate students, and 300,000 first-professional students who were enrolled at some time between July 1, 1995 and June 30, 1996.

The BPS sample consists of approximately 12,000 students identified in NPSAS:96 who were beginning postsecondary education for the first time. The first follow-up of the BPS cohort (BPS:96/98) occurred in the spring and summer of 1998, approximately 3 years after they first enrolled. Approximately 10,300 of the students who first began in 1995–96 were located and interviewed in the first follow-up. The weighted effective response rate for potential members of the BPS cohort in the NPSAS:96 base year was 77.6 percent. The weighted effective response rate in the 1998 follow-up of the NPSAS:96 respondents was 85.9 percent. The overall weighted response rate (including those who were nonrespondents in NPSAS:96) for the BPS:96/98 first follow-up was 79.8 percent.[14]

[13]For more information on the NPSAS survey, consult U.S. Department of Education, National Center for Education Statistics, *Methodology Report for the 1995–96 National Postsecondary Student Aid Study* (NCES 98–073) (Washington, DC: 1997). Additional information is also available at the NPSAS website *http://nces.ed.gov/npsas*.

[14]For more information on the BPS:96/98 survey, consult U.S. Department of Education, National Center for Education Statistics, *Beginning Postsecondary Students Longitudinal Study First Follow-up 1996–98, Methodology Report* (NCES 2000–157) (Washington, DC: 2000).

The BPS:96/98 Data Analysis System includes a sample weight for longitudinal analysis of the data through 1998 (B98AWT). All the estimates in this report are based on this weight.

Accuracy of Estimates

The statistics in this report are estimates derived from a sample. Two broad categories of error occur in such estimates: sampling and nonsampling errors. Sampling errors occur because observations are made only on samples of students, not entire populations. Nonsampling errors occur not only in sample surveys but also in complete censuses of entire populations. Nonsampling errors can be attributed to a number of sources: inability to obtain complete information about all students in all institutions in the sample (some students or institutions refused to participate, or students participated but answered only certain items); ambiguous definitions; differences in interpreting questions; inability or unwillingness to give correct information; mistakes in recording or coding data; and other errors of collecting, processing, sampling, and imputing missing data.

Data Analysis System

The estimates presented in this report were produced using the BPS:96/98 Data Analysis Systems (DAS). The DAS software makes it possible for users to specify and generate their own tables. With the DAS, users can replicate or expand upon the tables presented in this report. In addition to the table estimates, the DAS calculates proper standard errors[15] and weighted sample sizes for these estimates. For example, table B1 contains standard errors that correspond to table 1, generated by the DAS. If the number of valid cases is too small to produce a reliable estimate (less than 30 cases), the DAS prints the message "low-N" instead of the estimate.

In addition to tables, the DAS will also produce a correlation matrix of selected variables to be used for linear regression models. Included in the output with the correlation matrix are the design effects (DEFTs) for each variable in the matrix. Since statistical procedures generally compute regression coefficients based on simple random sample assumptions, the standard errors must be adjusted with the design effects to take into account the stratified sampling method used in the NPSAS and BPS surveys.

[15]The NPSAS:96 samples are not simple random samples, and therefore, simple random sample techniques for estimating sampling error cannot be applied to these data. The DAS takes into account the complexity of the sampling procedures and calculates standard errors appropriate for such samples. The method for computing sampling errors used by the DAS involves approximating the estimator by the linear terms of a Taylor series expansion. The procedure is typically referred to as the Taylor series method.

Table B1.—Standard errors for table 1: Percentage distribution of high school academic curricula among 1995–96 beginning students in 4-year institutions, by selected student background and high school characteristics

	Core curriculum or less[1]	Mid-level[2]	Rigorous[3]
Total	0.97	1.06	0.84
Gender			
Male	1.56	1.68	1.38
Female	1.21	1.36	1.00
Race/ethnicity			
Asian/Pacific Islander	3.52	4.23	3.57
Hispanic	3.15	3.53	2.74
Black, non-Hispanic	3.04	3.07	1.39
White, non-Hispanic	1.08	1.23	1.00
American Indian/Alaskan Native	—	—	—
Age during first month enrolled			
18 years or younger	1.02	1.12	0.85
19–24 years	3.02	3.01	2.75
Family income in 1994			
Low income	2.66	2.66	1.80
Middle income	1.09	1.20	0.91
High income	2.92	3.17	2.79
Parents' highest education			
High school or less	1.99	2.05	1.00
Some college	2.16	2.30	1.52
Bachelor's degree or higher	1.34	1.55	1.32
Derived SAT combined score			
Lowest quartile (400–790)	1.97	1.97	0.50
Middle quartiles (800–1090)	1.39	1.53	1.19
Highest quartile (1100–1600)	1.71	2.17	2.04
Free or reduced-price lunch eligibility at high school			
0–4 percent	1.74	2.03	2.00
5–24 percent	1.59	1.70	1.12
25 percent or higher	2.83	2.94	1.78

—Sample size too small for a reliable estimate.

[1]Core curriculum includes 4 years of English, 3 years of social studies, 3 years of mathematics, and 3 years of science.

[2]Mid-level curriculum exceeds core curriculum, but is less than rigorous. Includes at a minimum 1 year of a foreign language, geometry, algebra I, and 3 years of science including two of the following courses: biology, chemistry, or physics.

[3]Rigorous curriculum includes 4 years of English, 4 years of mathematics (including precalculus or higher), 3 years of a foreign language, 3 years of social studies, 3 years of science (including biology, chemistry, physics), and at least one advanced placement (AP) class or test taken.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98).

For more information about the BPS:96/98, and other Data Analysis Systems, consult the NCES DAS website (*www.nces.ed.gov/das*) or its West Coast mirror site (*www.pedar-das.org*), or contact:

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Statistical Procedures

Three types of statistical procedures were employed in this report: testing differences between means (or proportions), testing linear trends, and adjustment of means after controlling for covariation among several variables. Each procedure is described below.

Differences Between Means

The descriptive comparisons were tested in this report using Student's *t* statistic. Differences between estimates are tested against the probability of a Type I error,[16] or significance level. The significance levels were determined by calculating the Student's *t* values for the differences between each pair of means or proportions and comparing these with published tables of significance levels for two-tailed hypothesis testing.

Student's *t* values may be computed to test the difference between estimates with the following formula:

$$t = \frac{E_1 - E_2}{\sqrt{se_1^2 + se_2^2}} \qquad (1)$$

where E_1 and E_2 are the estimates to be compared and se_1 and se_2 are their corresponding standard errors. This formula is valid only for independent estimates. When estimates are not independent, a covariance term must be added to the formula:

[16] A Type I error occurs when one concludes that a difference observed in a sample reflects a true difference in the population from which the sample was drawn, when no such difference is present.

$$\frac{E_1 - E_2}{\sqrt{se_1^2 + se_2^2 - 2(r)se_1\ se_2}} \qquad (2)$$

where r is the correlation between the two estimates.[17] This formula is used when comparing two percentages from a distribution that adds to 100. If the comparison is between the mean of a subgroup and the mean of the total group, the following formula is used:

$$\frac{E_{sub} - E_{tot}}{\sqrt{se_{sub}^2 + se_{tot}^2 - 2p\,se_{sub}^2}} \qquad (3)$$

where p is the proportion of the total group contained in the subgroup.[18] The estimates, standard errors, and correlations can all be obtained from the DAS.

There are hazards in reporting statistical tests for each comparison. First, comparisons based on large t statistics may appear to merit special attention. This can be misleading since the magnitude of the t statistic is related not only to the observed differences in means or percentages but also to the number of students in the specific categories used for comparison. Hence, a small difference compared across a large number of students would produce a large t statistic.

A second hazard in reporting statistical tests for each comparison occurs when making multiple comparisons among categories of an independent variable. For example, when making paired comparisons among different levels of income, the probability of a Type I error for these comparisons taken as a group is larger than the probability for a single comparison. When more than one difference between groups of related characteristics or "families" are tested for statistical significance, one must apply a standard that assures a level of significance for all of those comparisons taken together.

Comparisons were made in this report only when $p \leq .05/k$ for a particular pairwise comparison, where that comparison was one of k tests within a family. This guarantees both that the individual comparison would have $p \leq .05$ and that for k comparisons within a family of possible comparisons, the significance level for all the comparisons will sum to $p \leq .05$.[19]

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[17]U.S. Department of Education, National Center for Education Statistics, A Note from the Chief Statistician, no. 2, 1993.

[18]Ibid.

[19]The standard that $p \leq .05/k$ for each comparison is more stringent than the criterion that the significance level of the comparisons should sum to $p \leq .05$. For tables showing the t statistic required to ensure that $p \leq .05/k$ for a particular family size and degrees of freedom, see Olive Jean Dunn, "Multiple Comparisons Among Means," *Journal of the American Statistical Association* 56 (1961): 52–64.

For example, in a comparison of males and females, only one comparison is possible (males versus females). In this family, k=1, and the comparison can be evaluated without adjusting the significance level. When students are divided into five racial/ethnic groups and all possible comparisons are made, then k=10 and the significance level of each test must be $p \leq .05/10$, or $p \leq .005$. The formula for calculating family size (k) is as follows:

$$k = \frac{j(j-1)}{2} \tag{4}$$

where j is the number of categories for the variable being tested. In the case of race/ethnicity, there are five racial/ethnic groups (American Indian/Alaskan Native; Asian/Pacific Islander; Black, non-Hispanic; Hispanic; and White, non-Hispanic), so substituting 5 for j in equation 4,

$$k = \frac{5(5-1)}{2} = 10$$

Linear Trends

While many descriptive comparisons in this report were tested using Student's t statistic, some comparisons among categories of an ordered variable with three or more levels involved a test for a linear trend across all categories, rather than a series of tests between pairs of categories. In this report, when differences among percentages were examined relative to a variable with ordered categories, Analysis of Variance (ANOVA) was used to test for a linear relationship between the two variables. To do this, ANOVA models included orthogonal linear contrasts corresponding to successive levels of the independent variable. The squares of the Taylorized standard errors (that is, standard errors that were calculated by the Taylor series method), the variance between the means, and the unweighted sample sizes were used to partition total sum of squares into within- and between-group sums of squares. These were used to create mean squares for the within- and between-group variance components and their corresponding F statistics, which were then compared with published values of F for a significance level of .05.[20] Significant values of both the overall F and the F associated with the linear contrast term were required as evidence of a linear relationship between the two variables. Means and Taylorized standard errors were calculated by the DAS. Unweighted sample sizes are not available from the DAS and were provided by NCES.

[20]More information about ANOVA and significance testing using the F statistic can be found in any standard textbook on statistical methods in the social and behavioral sciences.

Adjustment of Means to Control for Covariation

Many of the independent variables included in the analyses in this report are related, and to some extent the pattern of differences found in the descriptive analyses reflect this covariation. For example, when examining the percentages of those who were still enrolled or who had completed a degree at their initial institution 3 years after beginning postsecondary education, it is possible that some of the observed relationship with high school academic curriculum is due to differences in other factors related to academic preparation, such as college admission test scores, type of institution attended, and so on. However, if nested tables were used to isolate the influence of these other factors, cell sizes would become too small to identify the significant differences in patterns. When the sample size becomes too small to support controls for another level of variation, one must use other methods to take such variation into account. The method used in this report estimates adjusted means with regression models, an approach sometimes referred to as communality analysis.

To obtain estimates that were adjusted for the covariation among the entire set of independent variables identified as significant in the descriptive analyses, a multiple linear regression[21] was used to regress the dependent variable on the full set of independent variables. Each independent variable is divided into several discrete categories. To find an estimated mean value on the dependent variable for each category of an independent variable, while adjusting for its covariation with other independent variables in the equation, substitute the following in the equation: (1) a one in the category's term in the equation, (2) zeroes for the other categories of this variable, and (3) the mean proportions for all other independent variables. This procedure holds the impact of all remaining independent variables constant, and differences between adjusted means of categories of an independent variable represent hypothetical groups that are balanced or proportionately equal on all other characteristics included in the model as independent variables.

For example, consider a hypothetical case in which two variables, attendance status and gender, are used to describe an outcome, Y (remaining enrolled at the first institution). The variables attendance status and gender are recoded into a dummy variable representing attendance status, A, and a dummy variable representing gender, G:

[21] For more information about weighted least squares regression, see Michael S. Lewis-Beck, *Applied Regression: An Introduction*, Vol. 22 (Beverly Hills, CA: Sage Publications, Inc., 1980); William D. Berry and Stanley Feldman, *Multiple Regression in Practice*, Vol. 50 (Beverly Hills, CA: Sage Publications, Inc. 1987).

Attendance status	*A*
Full time	1
Part time	0
and	
Gender	*G*
Female	1
Male	0

The following regression equation is then estimated using the correlation matrix output from the DAS as input data for any standard regression procedures:

$$\hat{Y} = a + b_1 A + b_2 G \qquad (5)$$

To estimate the adjusted mean for any subgroup evaluated at the mean of all other variables, one substitutes the appropriate values for that subgroup's dummy variables (1 or 0) and the mean for the dummy variable(s) representing all other subgroups. For example, suppose *Y* represents remaining enrolled, and is being described by attendance status (*A*) and gender (*G*), coded as shown above, with means as follows:

Variable	Mean
A	0.90
G	0.55

To estimate the adjusted value for women, one substitutes the appropriate parameter estimates (obtained from standard regression procedures) and variable values (obtained from the DAS output) into equation 5.

Variable	Parameter	Value
a	0.392	—
A	0.227	0.900
G	0.017	1.000

This results in:

$$\hat{Y} = 0.392 + (0.017)(1) + (.227)(0.90) = 0.613$$

In this case, the adjusted mean for women is 0.613 and represents the expected outcome for women who resemble the average student across the other variables (in this example, attendance

status). In other words, the adjusted percentage of women remaining enrolled at their first institution after holding attendance status constant is 61.3 percent (0.613 x 100 for conversion to a percentage).

It is relatively straightforward to produce a multivariate model using the DAS, since one of the DAS output options is a correlation matrix, computed using pairwise missing values. In regression analysis, there are several common approaches to the problem of missing data. The two simplest are pairwise deletion of missing data and listwise deletion of missing data. In pairwise deletion, each correlation is calculated using all of the cases for the two relevant variables. For example, suppose you have a regression analysis that uses variables X1, X2, and X3. The regression is based on the correlation matrix between X1, X2 and X3. In pairwise deletion the correlation between X1 and X2 is based on the nonmissing cases for X1 and X2. Cases missing on either X1 or X2 would be excluded from the calculation of the correlation. In listwise deletion the correlation between X1 and X2 would be based on the nonmissing values for X1, X2, and X3. That is, all of the cases with missing data on any of the three variables would be excluded from the analysis.[22]

The correlation matrix can be used by most statistical software packages as the input data for least squares regression. That is the approach used for this report, with an additional adjustment to incorporate the complex sample design into the statistical significance tests of the parameter estimates. Most statistical software packages assume simple random sampling when computing standard errors of parameter estimates. Because of the complex sampling design used for the BPS survey, this assumption is incorrect. A better approximation of their standard errors is to multiply each standard error by the design effect associated with the dependent variable (DEFT),[23] where the DEFT is the ratio of the true standard error to the standard error computed under the assumption of simple random sampling. It is calculated by the DAS and output with the correlation matrix.

[22] Although the DAS simplifies the process of making regression models, it also limits the range of models. Analysts who wish to estimate probit/logit models (which are the most appropriate for models with categorical dependent variables) can apply for a restricted data license from NCES. See John H. Aldrich and Forrest D. Nelson, Linear Probability, Logit and Probit Models (*Quantitative Applications in Social Sciences*, Vol. 45) (Beverly Hills, CA: Sage, 1984).

[23] The adjustment procedure and its limitations are described in C.J. Skinner, D. Holt, and T.M.F. Smith, eds., *Analysis of Complex Surveys* (New York: John Wiley & Sons, 1989).

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